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THE NEUROTIC CONSTITUTION

A Statistical Study of Two Thousand Neurotic Soldiers

BY

ELIOT SLATER

(RECEIVED 8TH SEPTEMBER, 1942)

Introduction

The emergencies of war demanded the enlistment of an army of maximum size. The National Service Boards had to work with great rapidity, and with medical standards that were not so much lowered as dropped. The doctors composing these boards seem to have had but a sketchy knowledge of psychiatry, and no knowledge of the extent to which psychiatric disabilities can unfit a man for military duties. Large numbers of men proved useless within a few months or even weeks of enlistment, and arrangements had to be made to return them to civilian life as expeditiously as possible. Most of this work has been done by Army psychiatrists; but where there was a possibility that treatment might make a man fit for further service, or where his condition had so deteriorated that he was not fit for ordinary civilian work, admission to hospital has been arranged.

The clinical picture presented by these patients has been of a monotonous character. They were admitted to the Neurosis Centre on a psychiatrist's recommendation, and neurotic symptomatology was therefore to the fore. The obviously psychotic, mentally defective or physically ill went elsewhere; and though examples of these conditions have been seen, as is recorded, they usually showed an admixture of neurotic symptoms. In general the "neurosis" exhibited was not so much an illness as a simple failure to adapt to army routine and discipline, in part an incapacity to adapt, and a response to this incapacity. Whether ill or not, the commonest symptoms were those of anxiety, hysteria, depression, hypochondriasis, etc., and tended to be shown by members of all diagnostic groups. The causes of breakdown were of the same uniform character: separation from home and family, home worries, a life of relative hardship, army discipline, the pressure of tasks physically, intellectually or temperamentally beyond them. Only in a minority of patients were the more violent stresses of war the main precipitating factor. There have been a few who went through the Norwegian campaign, or served in the Middle East, or had to defend intensively attacked aerodromes or other places of military importance. But the evacuation from Dunkirk did provide a number of acutely ill patients; and here the operative stress seems to have been a combination of both physical and psychogenic factors: inadequate training, exposure to terrifying weapons of war (e.g. the dive-bomber, of which there had been no experience), the discouragement of defeat, prolonged marching with inadequate food, rest and sleep, etc. These patients offered a great contrast to the others, but they still presented the same constellation of anxiety, depression and hysteria, though in much severer degree. We have seen no single case of acute schizophrenia, as reported by Hubert, (1941) or of mania or psychotic depression released by such stresses, though there was a sufficiency of acutely agitated anxiety states, exhaustion syndromes and hysterical twilight states.

The monotonous character of precipitating cause and clinical picture was mirrored by a monotonous uniformity of the underlying personality. There were few who did not show to some degree a psychic asthenia, a feebleness of will and purpose, coupled with tendencies to worry, pessimism and moodiness or hysterical traits. This was indeed the fundamental disability, and indications had been shown in childhood and adult life. When one considers the large number of men who have had to be invalided for such conditions as these, one is impressed with the size of the problem. The analysis which follows attempts to give a general survey of the clinical material with which we have had to deal in one E.M.S. Neurosis Centre, and to elucidate the aetiological basis of this, socially, important group of patients.

The Statistical Method

In medicine, as elsewhere in science, statistical methods are only employed when exacter methods are not practicable. Under certain circumstances they are capable of yielding results of precision and reliability, but these are always the expression of a probability. Statistical methods can be employed in fields where the known stands in very unequal relation to the unknown, but they can be so used as to disguise ignorance and to cover the effects of factors which cannot easily be taken into account. The principal advantage of a statistical approach is that it permits the introduction of numerical methods in dealing with observations which are themselves purely qualitative. This advantage alone assures it an important future in psychiatry, where quantitative measurement of such things as degree of depression remains a dream of the future. For statistical methods to give reliable results there must be a certain uniformity in the material investigated, and there must be no biased sampling, no sources of systematic distortion of the results, whose presence is at once adventitious and unsuspected. In this material these criteria are only partly fulfilled. The patients are not a fair selection of the total psychiatric material of the Army, not to speak of the Armed Forces in general. There is on the one hand a negative selection of epileptics, defectives and the grosser psychopaths, who could be dealt with out of hand by the Army psychiatrists, of the delinquent who tended to seep into other channels, and of the psychotic and more severely psychopathic who were mostly admitted to Army mental hospitals. On the other hand only very small numbers of men were admitted from distant theatres of war. These factors affect different parts of our material to differing degrees. The schizophrenics are clearly a most unrepresentative selection, being only admitted by virtue of an error of diagnosis on the part of the Army psychiatrist, and therefore including only the quieter, more insidious and least typical forms of that illness. The same is to a lesser extent true of the epileptics, defectives, manic-depressives, and the psychopaths. In regard to the neuroses, our admissions represent probably a selection in favour of gravity, as the minor degrees of neurotic illness were frequently dealt with by regimental medical officers and Army psychiatrists in an out-patient capacity. Nevertheless our material, though not representative of all the psychiatric problems which face the Army organization, does give a fair picture of quite a large part.

It is frequently objected to psychiatric research that both diagnosis and the observations on which it is founded are matters of opinion and of degree, from which it is argued that the findings which are dealt with by statistical analysis must be largely subjective, and correspondingly worthless. The material here analysed is based on the day to day work of more than a dozen different psychiatrists, most of them of many years experience. Factors, then, which have a purely subjective value should be so randomly distributed as to have little influence on the results. It will in any case hardly be contended that such terms as schizophrenia and such observations as positive family history correspond to no biological reality; "and in so far as they do, differences between the various diagnostic and other groups will reflect to some extent the underlying fact. Statistics operate by an analysis of frequencies observed in qualitatively defined classes. The very finding of systematic differences between one class and another is evidence in favour of the real significance of the distinctions so drawn.

Collection of data.

The patients studied below were admitted to Sutton Emergency Hospital neuropsychiatric wards between November, 1939, and June, 1941. They were nearly all soldiers, but included a few sailors and airmen, but no civilians or members of civilian defence services. They were all men and below commissioned rank. In the course of ordinary history taking the psychiatrist filled in a summary form, in which specific yes/no answers were demanded to a considerable number of questions, with space for amplification where deemed necessary (e.g. on personality, symptoms, etc.). What these questions were will appear from the following tables. Not every psychiatrist was equally punctilious in filling the form, and definite information was not always available to every question. The consequence was that on a certain number of forms there were some queries or blanks where questions had been left unanswered. It is further clear that the detail in which questions were answered depended to some extent on the interest of the individual doctor, and the frequency of a positive family history, the number and even type of personality traits noted down, among other observations, varied from clinician to clinician. Eventually the summary form of the first two thousand serial admissions were taken, about a hundred excluded as containing too many blanks to be useful, and a further hundred or so forms from the next admissions added to make up the number to exactly two thousand. Where yes/no answers had not been possible, the relevant material was codified for counting. The Scientific Computing Service Limited * prepared summary tables using the Hollerith Punched Card System. The information given on each form was coded and punched on a card, and special machines (tabulators) then sorted the 2,000 cards into the various classes (of diagnosis, etc.), counted and printed the frequencies in each class. Finally the tables were submitted to statistical analysis.

In this paper the results will be discussed of analysis by diagnosis, by degree of stress undergone, and by outcome. It is possible that at a later time it may be worth recording the results of other counts that were made, e.g. by age, religious confession, sexual life. In the tables that follow, to avoid an excessive cumbersomeness, the presentation of absolute figures has been avoided and only percentages are given. But the totals on which the percentages are based are available in every case, and from these absolute figures could if desired be derived. Furthermore, although the standard errors of these percentages have been calculated, they have not been included in the tables; percentages which differ from that of the general average by more than twice the standard error of the difference have been taken as statistically significant, and in the diagnostic tables are printed in heavy type. In a certain number of patients a double diagnosis had to be made (e.g. mental defect + anxiety state, psychopathic personality + hysteria, head injury + depression), which has resulted in two thousand soldiers providing 2,037 diagnosis. In the diagnostic tables we have therefore the equivalent of 2,037 patients, and percentages have been calculated on

* With the aid of an expenses grant from the Maudsley Research Fellowship.

this total. In later tables only those particulars are entered which provided statistically significant deviations from the norm.

Diagnostic classification

Diagnoses were classified into the following groups:—

1. Organic States, inclusive of general paralysis, arteriosclerosis, neurological disorders, post-meningitic syndromes, and cases of cardio-vascular, respiratory and alimentary disorders incorrectly admitted as suffering from neurosis without physical basis. To have dealt with these groups severally would have made numbers too small for statistical handling.

2. Head Injury. Under this head come patients in whom there was thought to be a cerebral contusion or other lesion, old or recent, responsible for some at least of the symptoms. Grounds for this view were sometimes backed by an electroencephalogram, by the opinion of a consulting neurologist, or by indications of a typical change in personality dating from the time of the injury, but were sometimes rather nebulous; nevertheless patients in whom there was no evidence at all of neurological damage or anything more than concussion were excluded.

3. Epilepsy. Diagnosis was made on observation of a fit, of a typical history of fits or of periodic psychomotor attacks, or of petit mal waves in the E.E.G.

4. Schizophrenia.

5. Endogenous Depression. In this group were also included two cases of hypomania. The distinction between this group and that of the reactive depressions was based on such clinical findings as relative unimportance of precipitating factor, retardation, refractoriness of the depression to influence by suggestion, etc. The patients in this group could be regarded as manic-depressives or as suffering from involutional depression, with comparatively mild illnesses.

6. Mental Defect. Nearly all the patients so diagnosed were not so defective as to be certifiable, but they were all so dull and backward that it was considered that their defect was the main cause of failure in the Services and of admission to hospital.

7. Psychopathic Personality. This miscellaneous group included all patients in whom there was held to be a constitutional abnormality of personality of fairly severe degree, mainly responsible for any neurotic symptoms or failure of adaptation. The abnormality might be of any type, and included, for instance, cyclothymics, long-standing hysterics, the severely and chronically anxious, as well as those usually included under this head.

8. Anxiety Neurosis.

9. Hysteria.

10. Reactive Depression.

There were in addition three other small groups, too small to be dealt with severally: 20 obsessional neurotics, 16 enuretics without obvious other abnormality, 9 malingerers. The obsessional neurotics were a distinct group, though some patients of the same kidney were admitted with a fairly severe degree of depression and have fallen into groups 5 or 10. Enuresis was a fairly common symptom but was usually accompanied by mental defect or the signs of a chronic neurosis, justifying inclusion in one of the other groups; but it may appear alone in the likeness of an "organic neurosis," perhaps with a specific heredity, perhaps accompanied by spina bifida occulta. The malingerers were men who deliberately pretended to an illness they did not have. Cases on the borderline between hysteria and malingering were not included, nor those who exaggerated symptoms to some extent certainly present (a very common finding). Though nothing certain can be said of them owing to the smallness of their number, they seemed to be more normal constitutionally than the neurotics and psychopaths. All these three groups, though not dealt with separately, have been included in the totals and general averages.

Age, Religion, Occupation, Rank, Unit

The different diagnostic groups showed no significant differences one from another in respect of age. The average age of the whole group, which varied from 16 to 59, was 28·3 years. Patients with organic states (31·4), manic-depressives (30·2), and reactive depressives (30·5) were older than the average; epiletics (26·2), schizophrenics (26·9), and enuretics (23·4) were younger.

No significant differences were noted between the various groups in respect of religious confession, except that psychopaths belonged to the Church of England, with a frequency significantly less than the average. Of all the patients taken together, 1·6 per cent. were Jews, 12·6 per cent. were Roman Catholics, 13·2 per cent. Non-Conformists, and 72·5 per cent. belonged to the Church of England.

Occupations have been classified into only four groups. The fourth of these included men belonging to the professions (37), clerical workers (162), persons having their own shops and businesses (109), and other types of work or unstated (63). These subdivisions were too small to handle separately and were therefore combined into a group which is characterized by a more sedentary type of activity than those of the other three. From the table it may be seen that the defectives came, as might have

Diagnosis	No. observed	Occupation				Per cent. N.C.O.s
		Unskilled	Semi-skilled	Skilled	Other	
1. Organic states	51	27·5	50·5	5·9	15·7	21·6
2. Head injury	109	**24·8**	46·8	16·5	11·9	23·9
3. Epilepsy	70	40·0	38·6	8·6	12·9	**8·6**
4. Schizophrenia	50	32·0	26·0	8·0	**34·0**	**6·0**
5. Endogenous depression	51	**49·0**	**17·7**	**3·9**	29·4	29·4
6. Mental defect	137	**59·1**	**27·8**	**5·8**	**7·3**	**4·4**
7. Psychopathic Personality	265	37·7	34·0	**6·5**	22·6	20·0
8. Anxiety neurosis	647	31·9	41·7	11·3	15·1	18·2
9. Hysteria	384	30·6	38·8	9·9	21·1	17·4
10. Reactive depression ..	228	**26·4**	40·4	11·8	20·6	**26·8**
Total	2,037	33·2	38·4	10·1	18·2	18·4

TABLE 1.

been expected, preponderantly from the unskilled labourers. It is surprising to find that manic-depressives also come with significantly high frequency from the same group, in direct contrast to the reactive depressives who do so with a frequency significantly less than the average. Schizophrenics come from sedentary occupations with a frequency almost double the average, which accords well with what one knows of the "schizoid" personality. Psychopaths are but rarely skilled workmen, perhaps because a psychopathic personality would be a hindrance in completing an apprenticeship.

The frequency of N.C.O.s is highest in the obsessionals (35 per cent.), in the manic-depressives and the reactive depressives, in that order, although the numbers in the first two of these groups are too small to be significant. These are findings that might have been expected. Clinical experience suggests that manic-depressives are often superior men, and statistics gathered in Germany by Luxenburger (1933) have shown an association with better types of occupation, in contrast to our material. Epileptics, schizophrenics, and defectives have seldom won themselves promotion, again an expected finding.

The data with regard to unit have been omitted from the table, as not sufficiently interesting. Of the total material 40·2 per cent. of the patients came from non-combatant units, obsessionals with the lowest frequency (25 per cent.), cases of physical disorder and head injury with the highest (47·1 per cent. and 45·9 per cent.).

Physical and Sexual Constitution

The differential diagnosis of asthenic, athletic and pyknic habitus was made on impressions only. Elaborate and exact methods of physical measurement have led to confusion in the past, and hardly seemed worth the trouble of making. On the other hand well-marked representatives of all types are easy to recognise at a glance and though there are many men of whom it is difficult to say that they belong to one group rather than another, it was thought worth while to make the distinction where possible. No great value is claimed for these figures. In only about half the patients was any entry made in the record of the bodily habitus, which has necessitated doubling the figures by adding a further series from later admissions to get significant results. One notes the high preponderance of the asthenic habitus, the endogenous depressives singling themselves out from the rest by having a marked preponderance of persons of pyknic habitus.

Investigation of the sexual lives of our patients indicated that this was at least as important from the point of view of constitution as of psychogenesis. The number of men in whom sexual relations began at a late age, occurred with unusual rarity and were associated with little interest or satisfaction, was so high as to attract attention and to lead to the inclusion of a specific question in the summary form. "Inhibited" is really the wrong word, and "impoverished" or "inadequate" would be a better one, because the infrequency of sexual activity was far more often caused by lack of libido than by self-restraint. In general it may be said that complete abstinence was not regarded as "inhibition" until full adult life, say 25 years of age, was reached. The majority of our patients were married, and in these a coitus frequency of less than once a fortnight would generally be regarded as evidence of inhibition. In the analysis of the total material by sexual life several interesting correlations were found, for instance of inhibition with the asthenic and pyknic physiques, and with a poor outcome; but it is hoped to combine these with a genetic and biochemical investigation which is being undertaken at the present time, and will be made the subject of a later communication. From Table 2 it may be seen that an inhibited sex life is especially frequent among mental defectives and psychopaths, especially infrequent in cases of head injury. It is clearly a quality of deep biological significance, and it may be that it is genetically associated with the factors that make for inferiority of intelligence and temperament.

Mental Constitution, Affective

In 55·7 per cent. of our patients there was a positive family history, i.e. one or more of the first-degree relatives, parent, sib or child, had suffered

Diagnosis	Bodily habitus				Sexual life	
	Number recorded	Asthenic	Athletic	Pyknic	Number recorded	Inhibited
1. Organic states	74	39·2	33·8	27·0	36	50·0
2. Head injury	87	36·8	34·5	28·7	60	**23·3**
3. Epilepsy	60	38·3	35·0	26·7	50	44·0
4. Schizophrenia	56	39·3	37·5	23·2	35	54·3
5. Endogenous depression	52	25·0	23·1	**51·9**	28	53·6
6. Mental defect	131	51·1	35·9	**13·0**	85	**57·6**
7. Psychopathic personality	311	46·3	33·8	19·9	193	**51·8**
8. Anxiety neurosis	710	47·7	30·4	21·8	469	38·6
9. Hysteria	392	**38·3**	34·4	27·3	280	42·1
10. Reactive depression ..	232	44·4	29·3	26·3	176	40·9
Total	2,105	43·8	32·3	23·9	1,412	43·1

TABLE 2.

from definite neurotic illness or psychosis or epilepsy or from some form of psychopathy (such as drunkenness, shiftlessness or violent and brutal habits) which had entailed undesirable social consequences. As information was obtained almost exclusively from the patient himself, no claim can be made that the figures are of any absolute value; they would indeed appear to be minimum ones. It is of interest that a family history of fits is given not only by a third of the epileptics but by 10 per cent. of the defectives, and that comparatively high frequencies of a family history of psychoses are found in the schizophrenics and endogenous depressives. Generally, a positive family history is found with significant rarity in the physical states, with significant frequency in the psychopaths. The remarkably high figure provided by the latter supplies a strong suggestion that genetic factors productive of mental abnormality can reinforce one another and act cumulatively.

Some degree of childhood neurosis is shown by 58·8 per cent. of the total material, the frequency of definite neurosis being significantly high for the psychopaths, significantly low for the two organic groups and for the manic-depressives. This is one of the many ways in which the endogenous depressions distinguish themselves from neurotic states. It is to be remembered that the frequency of some degree of nervousness in childhood is probably quite high in the average population, even in children who grow up to be quite normal adults; but from the facts provided here it seems clear that neurotic symptoms in childhood, especially if they reach at all a severe degree, are of considerable significance for later life.

Almost a quarter of our patients had had a previous nervous breakdown, and of the endogenous depressives over two-thirds. It is probable that in these latter this finding was used as a diagnostic criterion.

The frequency of an abnormal personality is also shown to be high, over 40 per cent. in the whole group, and in no category less than 20 per cent. Persons so marked were held to show a degree of abnormality of personality, in structure and development, which could not be regarded as within the normal limits of variation of the population. A fairly well adjusted man, with some but no very serious neurotic or psychopathic traits, would not come within this definition. It will be seen that the organic syndromes score comparatively low figures, while the schizophrenics distinguish themselves by showing a high frequency of abnormality of the premorbid personality. The total frequency of abnormal personality in the whole group, including the psychopaths, is 48·3 per cent.

The individual personality traits are tabulated in Table 4, which is one of exceptional interest. It will be seen that throughout, with one non-significant exception, the organic syndromes do not reach the level of frequency of the general average, and for the most part are significantly below it. Epileptics score low values for all traits, except paranoid and impulsive tendencies; in the latter they have a high figure, and one which only just fails of significance. Schizophrenics are markedly lacking in hysterical traits, markedly rich in paranoid and unsociable tendencies, which would seem, from this admittedly unrepresentative material, to be the main features of the "schizoid" personality. The endogenous depressives score figures consistently lower than the average, and often significantly lower, in all qualities but obsessional tendencies and instability of mood. The latter is an expected finding, the former much less so, although some relation between manic-depressive syndromes and obsessional neurosis and the obsessional character has long been suspected. In this respect the reactive depressives resemble the endogenous depressives, as also in the low frequency of hysterical and impulsive and aggressive tendencies. But in general they deviate much less sharply from the average, and show a much higher incidence of anxiousness of disposition, in which the endogenous depressives rank significantly low. The mental defectives score figures which are for the most part rather lower than

Diagnosis	Positive family history			Childhood		Previous nervous breakdown	Abnormal personality
	General	Epilepsy	Psychosis	Neurosis	Neurosis and minor neurotic traits		
1. Organic states ..	**37·3**	2·0	6·8	**13·7**	**35·3**	13·7	31·4
2. Head injury	**32·1**	3·7	1·8	**6·4**	**27·5**	**9·2**	**22·0**
3. Epilepsy..	55·7	**28·6**	2·9	24·3	47·2	**12·9**	35·7
4. Schizophrenia ..	52·0	4·0	8·0	24·0	60·0	34·0	**62·0**
5. Endogenous depression	62·8	2·0	9·8	**13·7**	45·1	**68·6**	41·2
6. Mental defect ..	56·2	10·1	5·8	26·3	55·5	**16·1**	49·6
7. Psychopathic personality	**72·5**	8·7	6·4	**45·7**	**76·6**	28·7	—
8. Anxiety neurosis ..	56·7	5·9	3·2	26·4	62·4	23·2	39·9
9. Hysteria..	50·8	4·9	4·1	24·7	55·4	22·9	43·2
10. Reactive depression	55·7	**3·1**	4·8	21·1	57·5	22·4	45·2
Total ..	55·7	6·4	4·4	26·3	58·8	23·1	41·4

TABLE 3.

the average, significantly so in obsessional tendencies, instability of mood, and unsociability ; it is a little surprising that they do not show up more for anergic tendencies and lack of initiative, which would seem therefore to be almost purely a temperamental quality. It has often been asserted and denied that obsessional neurosis is rare in mental defectives ; there is some evidence here that there is a negative association between mental defect and the obsessional character. Anxiety neurotics in general approximate to the average of the whole group, but show as was to be expected a higher incidence of anxiousness of personality, and also a low incidence of hysterical tendencies and aggressiveness. The hysterics conform fairly well to the general average, but rank low in the frequency of obsessional traits, lability of mood and unsociability ; as was to be expected they show a high incidence of hysterical traits of character. The psychopaths score very high figures throughout the table, with the single exception of obsessional traits. It is interesting that, taking the material as a whole, the most common abnormal traits of personality were undue lability of mood, lack of interest in and talent for mixing socially with the rest of mankind, an anergia and spinelessness of character, and tendencies to anxiety ; the least frequent traits were hypochondriasis and paranoid traits.

Mental Constitution, Intellectual

The school record shows, expectedly, conspicuous failure on the part of the defectives ; cases of head injury, endogenous and reactive depression are associated with records better than the average. In this table a poor school record was taken as failure to reach the top standard of an elementary school by the age of 14, a good record as education at a Central or Secondary School, or better. The intelligence ratings were based for the greater part on a simple clinical impression and such intellectual tests of a brief character as are commonly applied in the course of a routine examination. Group intelligence tests were performed on a fair minority of the patients, but they themselves were not entirely reliable. Some patients, particularly those of a hysterical disposition, who were out to show themselves as unfit as possible, did conspicuously badly on the intelligence test ; a repeated test would frequently produce a ten point rise or more in the I.Q. It will be seen that the intelligence ratings mirror fairly closely the school record. The epileptics and the hysterics tend to be of lower intelligence than the average ; the organic patients, depressives of both kinds, and the schizophrenics tend to do better than the rest of the material. The low rating obtained by the hysterics is of interest. As has already been stated, the figures are of rather doubtful validity but they cannot be entirely disregarded. The psychopaths, who, as will be shown, were as anxious as the hysterics to earn their discharge from the army by fair means or foul, do not show the same association with a low intelligence rating. Furthermore, as will appear later, mental defectives tend particularly to a hysterical type of neurotic symptomatology. There is a definite suggestion, then, of a real association of hysteria with subnormal intelligence. The most important finding given by the table is, however, that provided by the general averages. It will be seen that about a third of these patients were of poor intelligence and that the frequencies of the various groups differ sharply from the " normal " type of curve provided by the general population,* and in this population of neurotics the curve is markedly skewed, persons of low intelligence being represented in far great numbers than those of superior intelligence. The only groups to conform fairly closely to the normal distribution are the organic states, the schizophrenics and the endogenous depressives. It seems probable that subnormality of intelligence and of temperamental stability rein-

* And by Army entrants tested with the same methods by the Directorate of Selection of Personnel. For a detailed examination of our material on this point, see Halstead (1943).

Diagnosis	Personality traits									Number of abnormal traits per patient
	Obsessional	Anxious	Hysterical	Unstable mood	Hypochondriasis	Paranoid sensitive	Impulsive aggressive	Unsociable	Anergic	
1. Organic states ..	13·7	**3·9**	11·8	23·5	**2·0**	7·8	17·6	**17·6**	**7·8**	1·1
2. Head injury ..	**9·2**	**9·2**	**7·3**	**15·6**	**1·8**	9·2	26·6	**19·3**	16·5	1·1
3. Epilepsy	15·7	**10·0**	**7·1**	31·4	**1·4**	20·0	31·4	28·6	20·0	1·7
4. Schizophrenia ..	26·0	16·0	**4·0**	38·0	10·0	**32·0**	30·0	**46·0**	22·0	2·2
5. Endogenous depression ..	**37·3**	**11·8**	**5·9**	**60·8**	3·9	7·8	11·8	25·5	**7·8**	1·7
6. Mental defect ..	**5·8**	30·7	9·5	**23·3**	6·6	9·5	16·8	**23·4**	25·6	1·5
7. Psychopathic personality ..	23·0	**30·2**	**20·0**	**47·2**	**12·8**	**24·5**	**36·2**	**44·9**	**36·2**	2·8
8. Anxiety neurosis..	20·6	**29·1**	**9·6**	32·1	6·5	10·5	**14·5**	32·0	24·3	1·8
9. Hysteria	**14·6**	19·3	**26·9**	**26·0**	7·8	10·7	20·8	**25·5**	22·4	1·7
10 Reactive depression	**30·3**	22·4	**7·5**	**44·3**	9·2	11·0	**14·5**	32·5	20·6	1·9
Total ..	20·0	23·5	13·6	33·4	7·4	13·0	20·2	31·0	23·8	1·9

TABLE 4.

force one another in producing failure of adaptation, and that in any collection selected on this criterion one will see the intermingling of both factors. The more stable defectives and the more intelligent neurotics will as a rule more easily escape the net spread for either.

Preconditioning

The frequency of a bad home environment, of a bad relationship with the father, of previous army service and of previous war service were analysed, but are not included in a table. These were the only factors whose effect in the environmental predisposition towards neurosis could be attacked, and the result was inconclusive. We found a bad home, in the sense of excessive poverty, drunkenness or family disagreement in 20·9 per cent. of patients, a bad relation with the father in 15·6 per cent. Both findings were significantly more frequent in the psychopaths (30·6, 26·8 per cent.), significantly less so in the two organic groups (1. 5·9, 5·9 per cent. ; 2. 13·8, 8·3 per cent.). But although a bad home environment may certainly predispose to neurosis, the finding is entirely ambiguous, as it is probably also an expression of neurosis or psychopathy in the parents, and thereby a function of bad heredity. The two effects, environmental and hereditary, cannot be disentangled, as they are necessarily bound up together. The number of men who served in the last war, 12·4 per cent., is surprisingly high. They were nearly all volunteers, and all middle-aged men, most of whom broke down under the severe weather conditions of the first winter in France, and a reactive depressive illness was significantly more common among them.

Precipitation

The innumerable external factors which may actually precipitate a breakdown do not readily lend themselves to analysis, but more easily so in the present than in a normal peace-time material. They were most commonly the stresses of war, comparatively hard life and discipline in the army, separation from family and home, home worries of various kinds (e.g. the illness of relatives, financial stress, destruction of the home by bombing, worries about a possibly unfaithful wife, etc.), and physical ill-health. Some factor of one of the above kinds had fairly clearly played a part in nearly half the patients. In the remainder, breakdown had occurred under military conditions which were far from onerous, and these subjects must be regarded as being of a very low level of constitutional adaptability. The lowest figure is scored by schizophrenia, which would therefore in this material appear to be almost wholly endogenous. Epileptics, those suffering from organic states other than head injury, mental defectives, and psychopaths all became unfit with comparatively little in the way of additional environmental stress. In contrast to the other reactive states, the anxiety neuroses show themselves as associated with special frequency with some definite precipitation. They manifest the same phenomenon in their association with military stress, being the only diagnostic group to show a positive correlation there. Although anxiety neuroses constituted only 32 per cent. of the total material, they were diagnosed in 46 per cent. of the patients who went through some degree of military stress. This particular precipitating factor will be discussed in greater detail later on. The incidence of head injury provides interesting figures. Head injury, perhaps only a moderate degree of concussion, had occurred at some time in 13 per cent. of all patients, excluding those specifically diagnosed as traumatic syndromes. The incidence is low in the endogenous depressives and schizophrenics, but significantly high in the epileptics. Other physical disabilities (orthopaedic abnormalities, such illnesses as chronic bronchitis, etc.) were present in a further 14 per cent., and one notes that a relatively high proportion of the reactive depressives were handicapped by physical factors, and that many of the hysterics hung their symptoms on to some genuine physical disability. The psychogenic factors associated with adverse home situations show no predilection for one diagnostic group as compared with others, except that they were especially frequent in the psychopaths ; this is presumably to be taken as an expression of the

Diagnosis	School record		Intelligence			
	Poor	Good	Recorded	Poor	Average	Good
1. Organic states	29·4	17·6	38	21·1	60·5	18·4
2. Head injury	**20·1**	13·8	76	25·0	69·7	5·3
3. Epilepsy	37·1	10·0	57	**47·4**	**42·1**	10·5
4. Schizophrenia	22·0	18·0	40	20·0	65·0	15·0
5. Endogenous depression ..	**19·6**	13·7	33	18·2	69·7	12·1
6. Mental defect	**85·4**	**0·0**	—	—	—	—
7. Psychopathic personality ..	30·2	15·5	212	33·5	55·2	11·3
8. Anxiety neurosis	28·1	15·5	546	29·9	60·6	9·5
9. Hysteria	29·7	11·9	322	**39·8**	52·5	7·8
10. Reactive depression	**21·0**	17·1	181	**23·8**	64·1	12·2
Total	31·2	14·2	1538	31·2	58·5	10·3

TABLE 5.

psychopath's tendency to make unhappiness for himself wherever he goes, rather than as evidence of any causative relation in the other direction.

Symptomatology

Roughly half our patients had been ill for periods of less than six months, a quarter for six months to two years, and a quarter for over two years. By this is meant not the duration of the condition, but of obvious disability or active symptoms caused by it. It will be seen that clear signs of epilepsy, mental defect and psychopathic personality had been present in a high proportion of those diagnostic groups considerably before the time the men concerned were enlisted. Very large numbers of these men, who were as a rule useless as soldiers from the beginning, might have been kept out of the army had they been given even the most cursory psychiatric examination, with a corresponding gain in efficiency in their units and in the medical services. Of all the diagnostic groups, the anxiety states distinguish themselves by being most frequently of recent origin.

Turning to the symptoms themselves we note that by far the commonest symptoms are depression, anxiety, and hypochondriasis in that order. These symptoms are shown with considerable frequency by every diagnostic group and therefore seem to have a rather non-specific character, although they are relatively less frequent in the organic and endogenous states. Hysterical symptoms, next in order of frequency, show a sharper differentiation and are very rarely found in schizophrenic and manic-depressive syndromes. All these symptoms, with the exception of hypochondriasis, are shown by the psychopaths with a frequency considerably greater than the average. Paranoid symptoms are less frequently shown, most abundantly by the schizophrenics and psychopaths. The great rarity of obsessional symptoms will be noted. The only groups to show them with any frequency are the schizophrenics, the psychopaths, and the reactive depressives. In this point there is a sharp cleavage between the reactive and endogenous depressions. The association between obsessional personality traits and the occurrence of a depressive illness has already been shown in this material; and it may be that some of these reactive depressives with obsessional symptoms might have been as suitably diagnosed as cases of obsessional neurosis. Symptoms of a non-neurotic, i.e. psychotic or organic, nature are but rarely seen in the neurotic states, with the exception of the psychopaths. They are symptoms which one knows from clinical experience have a highly specific nature and great diagnostic value. Finally, the quality designated by the term "scrimshanking," i.e. the wilful exaggeration of symptoms and illness to secure some aim, such as invaliding from the army, is recorded as grossly obvious only in little more than 5 per cent. of the patients, but with more than double that frequency in the hysterics and psychopaths. The interesting amnesic and dysmnesic symptoms have been dealt with in a previous communication (Sargant and Slater, 1941).

Statistical figures reflect the uniformity, but not the fluidity of the symptomatology in the neuroses. Apart from its dependence on the underlying personality, there was nothing fixed and stable in the clinical picture. A man admitted in a state in which anxiety symptoms were to the fore, might pass in the course of a week or two into one of listlessness, apathy and mild depression, or into one of dissociation with conversion symptoms or gross hysterical display. In general as the days passed and the patient settled into hospital, saved for the time being from the situation of stress, affective features tended to recede into the background and in their place hysterical aspects of the personality showed up for the first time; in the endeavour to remain in his asylum, the patient hollowly repeated complaints which had long lost their basis in feeling and reality, endeavoured to claim the sympathy of the doctor or became resentful and disgruntled and threw the blame for his failure on the shoulders of others. Experience constantly fortified the impression that symptoms in themselves are of secondary importance. They may indicate a line of approach and determine the immediate treatment but are of significance for prognosis and ultimate disposal only

Diagnosis	Precipitation	Head injury	Physical factors	Unsat. home	Military stress		
					Severe	Moderate	Trifling
1. Organic states	**31·4**	13·7	—	13·7	**5·9**	21·6	**72·5**
2. Head injury	—	—	—	11·9	27·5	20·2	52·3
3. Epilepsy	**20·0**	**27·1**	15·7	11·4	**7·1**	**8·6**	**84·3**
4. Schizophrenia	**10·0**	**6·0**	**6·0**	22·0	**8·0**	12·0	**80·0**
5. Endogenous depression ..	35·3	**5·9**	9·8	15·7	**7·9**	**7·9**	**84·3**
6. Mental defect	**31·4**	18·2	17·5	13·1	16·1	**10·9**	**73·0**
7. Psychopathic personality ..	**33·2**	12·8	9·8	**28·7**	**13·6**	18·8	**67·6**
8. Anxiety neurosis	**61·4**	11·4	14·7	12·2	**32·3**	**28·7**	**38·9**
9. Hysteria	48·4	**19·0**	**19·3**	11·7	20·3	18·2	61·5
10. Reactive depression ..	47·8	11·0	**21·9**	14·9	19·3	21·5	59·2
Total	47·6	13·0	14·3	14·7	21·5	21·0	57·5

TABLE 6.

in so far as they act as indicators of something more fundamental. An exception is to some extent provided by the depressives. In patients suffering from depression it might be only after some weeks that the nature of their illness became apparent, when attempts at therapeutic influence had failed to change their state. This was particularly likely to be observed where there was an endogenous factor in the illness which was not at first apparent. Most of these men took longer to get better than the average, and official restrictions on the possibility of convulsive treatment were a handicap.

Treatment

Analysis of the figures by the method of treatment employed has been done but the results are not of sufficient interest to publish. Nearly 60 per cent. of the patients received no specific treatment other than that provided by the usual hospital routine, physical training, occupational therapy, etc., and perhaps a few short therapeutic interviews. Psychotherapy of a rather more intensive degree was given in nearly a fifth of the patients (18·7 per cent.), with especial frequency in the hysterics (36·2 per cent.); only half as many (18·2 per cent.) of the anxiety neurotics were so favoured. About 5 per cent. of the anxiety neurotics received continuous narcosis, which was otherwise little employed, for the most part with the quick inrush of acutely ill patients after Dunkirk. But some form of specially directed sedation was of much more general use. Eighteen per cent. of the schizophrenics were found fit for insulin coma treatment, a high figure considering the rather insidious nature of the illness in our patients. A modified form of insulin thereapy (Sargant and Craske, 1941) was found useful as a form of physical rehabilitation in a wider variety of patients, particularly those who had undergone considerable loss of weight. Previous papers by Cameron (1940), Sargant and Slater (1940) and Debenham *et al.*(1941) have discussed the methods of treatment most generally used in dealing with these patients; but by and large they constituted a therapeutically unfavourable material. The possibilities of treatment were limited on the one hand by the frequency of a rather low intelligence and firmly anchored constitutional instability, on the other hand by working conditions. There was great pressure on beds and a rapid turn-over. The time which the physician could spend with any one patient was very limited. The patients had every incentive not to improve, because thereby they might ensure escape from return to duty; and the concentration of large bodies of men of low morale in one hospital aided the spread of this attitude.

Results

In only one-tenth of the patients could complete recovery be obtained, but great improvement resulted in a further quarter. Complete recovery was most frequently seen in the endogenous depressives and in the hysterics, although it must be admitted that in both groups it was symptomatic, and the fundamental constitution was left unaltered. Great improvement was as a rule the best that could be hoped for in the anxiety neurotics, even in the most recent and favourable; the continuing stresses of war, the threat of air-raids, etc., were sufficient, even if the patient was discharged to civilian life, to prevent the possibility of removing all anxiety feelings. Nevertheless, taking great improvement and recovery together, the anxiety neurotics and the depressives did better than the hysterics, who only score an average figure, all other diagnostic groups doing comparatively badly. It will be noted that the highest rates of return were obtained in the organic

Diagnosis	Duration in months				Symptomatology									
	under 1	1–6	6–24	over 24	Obsessional	Anxiety	Hysterical	Amnesia	Fits and faints	Mood change	Hypochondriacal	Paranoid	Organic and non-neurotic	"Scrimshanking"
1. Organic states	15·7	29·4	25·5	29·4	**0·0**	**21·6**	**13·7**	**7·8**	9·8	**25·1**	**17·6**	11·8	—	**0·0**
2. Head injury	13·8	36·7	26·6	22·9	**0·9**	38·5	26·6	—	13·8	33·9	**56·9**	17·4	**55·1**	1·8
3. Epilepsy ..	**4·3**	**18·6**	**15·7**	**61·7**	1·4	**22·8**	21·4	18·6	—	**27·1**	**20·0**	14·3	**32·9**	1·4
4. Schizophrenia	**6·0**	34·0	34·0	26·0	8·0	**20·0**	**2·0**	14·0	4·0	38·0	**24·0**	**36·0**	—	**0·0**
5. Endog. depn.	17·6	43·1	17·6	21·6	**0·0**	35·3	**2·0**	**7·8**	**2·0**	—	31·4	21·6	**51·0**	**0·0**
6. Mental defect	10·9	**27·7**	27·7	**33·6**	3·7	44·7	**38·7**	**11·7**	**16·1**	38·7	38·0	11·7	**16·1**	**2·2**
7. Psychopathic personality..	10·6	34·3	22·3	**32·9**	**7·2**	**54·7**	**46·8**	16·2	8·7	**56·6**	40·0	**30·6**	10·6	**13·2**
8. Anxiety neurosis ..	15·9	**42·3**	26·0	**15·7**	**1·7**	—	27·2	**13·0**	**4·8**	**53·0**	40·3	**11·4**	**1·2**	**2·5**
9. Hysteria ..	18·2	37·2	25·0	19·5	2·1	45·1	—	**34·4**	**13·1**	**35·2**	**49·0**	15·4	**0·5**	**13·3**
10. Reactive depression ..	15·8	42·1	25·4	**16·7**	**6·6**	42·6	**19·7**	**12·7**	2·6	—	43·4	14·9	5·3	**2·6**
Total ..	14·4	37·2	25·0	23·4	3·2	43·7	27·9	19·1	7·4	45·0	40·9	16·4	9·8	5·7

TABLE 7.

and head injury patients, in the anxiety neurotics, hysterics, and depressives, in that order; other groups showed a conspicuously low rate of return. Four per cent. of the patients had to be transferred to other hospitals, though the figure is much higher in the schizophrenics and endogenous depressives, many of whom were too ill for treatment in our hospital and had to be removed to a neighbouring mental hospital. Nearly three quarters of the patients had to be invalided.

Follow-up records are available for 336 patients returned to duty, of whom approximately half later broke down again and had to be invalided any time from a few weeks or months to a year after discharge. The numbers are not big enough to provide significant differences in the individual groups, and for a detailed study of follow-up histories of neurotic soldiers the reader is referred to the paper by Lewis and Slater (1942). Later on in the history of the hospital, both the rate of return to duty and the follow-up statistics were greatly improved by new administrative arrangements for the Army as a whole. By this system it became possible to transfer a man from one unit to another on psychiatric grounds, to arrange his allotment to duties particularly suited to him, and to recommend him for a posting in the neighbourhood of his own home. At the time when the patients discussed here were discharged, they had either to go back to their own units to take pot luck in the duties that would be assigned to them, or to be boarded out of the army altogether.

These results are of course very disappointing. It seems that we are still very far from an effective, not to speak of a specific, method of treatment of the neuroses. The treatment of a neurotic patient resolves itself into two parts, the adjustment of the patient to his environment and the adjustment of the environment to the patient. That the latter is an effective method has been shown by our later results, when modification of the environment was possible along the lines outlined above. It is in the readaptation of the patient that psychiatric treatment breaks down. No matter what the main system of treatment employed, the results are always about the same. As Curran (1937) showed on a peace-time material, the results of a simple out-patient supervision are as good as those claimed by the exponents of intensive psychotherapy. And on a series of military neurotic patients very similar to ours, the results obtained at the 41st General (Neuropathic) Hospital, as reported by Hadfield (1942), by psychiatrists of strongly psychotherapeutic leanings are almost identical with ours—20 per cent. of men returned to the army, of whom 40 per cent. broke down within three months. It would seem that what a man is by heredity and constitution is much more decisive for his future than any trifling alterations that can be brought about in him by psychotherapy and mental and physical rehabilitation.

The Diagnostic Groups

We now come to consider the diagnostic groups as a whole. The main particulars in which the individual groups show significant deviations from the general average are illustrated in Table 9. We note that the organic syndromes score figures significantly lower than the average practically everywhere; they are constitutionally a much more normal population, have less in the way of neurotic traits of personality and correspondingly less in neurotic symptomatology, but are on the other hand liable to their own specific symptoms. The same is to a lesser extent true of the epileptics, the mental defectives, the schizophrenics and the endogenous depressives, as far as neurosis is concerned. The mental defectives show an increased liability to hysteria, and they and the psychopaths are the only groups to show a special liability to a generally impoverished sexual life. The schizophrenics tend to be abnormal personalities, with marked tendencies

Diagnosis	Improvement				Disposal			Follow-up		
	None	Slight	Great	Recovery	Returned to duty	Transfd.	Invalided	No. Obsd.	Success	Failure
1. Organic states ..	**47·1**	**25·5**	**13·7**	13·7	30·6	8·2	61·2	11	36·4	63·4
2. Head injury ..	24·8	48·6	19·3	7·3	27·8	11·3	60·8	23	65·2	34·8
3. Epilepsy	**54·3**	32·9	**12·9**	**0·0**	**7·7**	4·6	**87·7**	4	0·0	100·0
4. Schizophrenia ..	**62·0**	**22·0**	**10·0**	6·0	**8·3**	**35·4**	**56·2**	4	75·0	25·0
5. Endogenous depression ..	21·6	35·3	27·5	15·7	22·9	**22·9**	**54·2**	9	66·7	33·3
6. Mental defect * ..	**40·1**	43·1	**10·9**	5·8	**12·2**	4·1	**83·7**	14	14·3	85·7
7. Psychopathic personality * ..	**30·2**	45·7	**18·2**	**6·0**	**10·0**	3·2	**86·7**	23	34·8	65·2
8. Anxiety neurosis ..	**14·6**	42·5	**33·2**	9·7	**26·5**	**1·0**	72·5	122	52·5	47·5
9. Hysteria	**17·7**	40·9	**20·0**	**15·4**	25·2	3·1	71·7	77	50·7	49·4
10. Reactive depression	**16·6**	39·0	31·6	12·7	22·3	2·8	74·9	40	60·0	40·0
Total	23·5	41·2	25·2	10·0	21·5	4·3	74·1	336	50·3	49·7

TABLE 8.

* Improvement and recovery are from presenting neurotic symptoms. The disposal figures in this table have suffered a systematic distortion, not now to be corrected; the rate of return was not 21·5 but 24·1 per cent. This error, however, should have no effect on comparisons drawn between one diagnostic group and another.

towards a paranoid and unsociable attitude, but on the other hand show an absence of hysterical traits of personality and of neurotic symptomatology when ill. Relative freedom from constitutional hysterical tendencies also distinguished the anxiety neurotics, who show otherwise most importantly an association with illness of definite exogenic precipitation and of short duration. The hysterics show a positive association with subnormal intelligence, a negative association with obsessional traits of personality and instability of mood ; when ill they tend to hypochondriasis and somatic fixation of symptoms. Persons diagnosed as psychopaths show a markedly increased liability to every sort of abnormal manifestation, with the few exceptions of poor intelligence, repeated breakdown, obsessional and hypochondriacal tendencies.

The endogenous and the reactive depressives are worth somewhat closer examination, particularly as there is frequent discussion on whether they should not be considered quantitatively different manifestations of what is fundamentally the same syndrome. We note that both groups show a negative association with poor intelligence and hysterical traits, a positive association with obsessional tendencies. On the other hand, whereas more than half the endogenous depressives were of pyknic constitution, reactive depressives showed this type of bodily habitus with hardly more than average frequency ; childhood neurosis is rare in the endogenous depressives, of almost average frequency in the reactive group. When all the tables are gone through it will be found that the figures provided by the endogenous depressives do not occupy an intermediate position in among the figures provided by the reactive depressives, the anxiety neurotics and the hysterics, but rather lie at one extreme, now one and now another of the neurotic groups approaching them most closely. The question of the existence of a real difference can be put to a specific test, which yields a decisive result in its favour.

I have taken the records of 94 endogenous depressives, all that were accessible and sufficiently complete, and of 254 reactive depressives, and examined the frequencies of association of childhood neurosis, previous nervous breakdown, anxious and anergic traits of personality and pyknic habitus. If previous nervous breakdown and pyknic habitus can be regarded as " endogenous " signs, and the others as " reactive " signs, the findings can be divided into three groups : 1. Endogenous outnumber reactive signs, 57 endogenous depressives, 54 reactive depressives ; 2. Endogenous and reactive signs are present in equal number, 31 and 104 ; 3. Endogenous are outnumbered by reactive signs, 6 and 96. The χ^2 of this distribution is 57·4, indicating that the two groups certainly cannot be regarded as different samples of the same population. If it is not regarded as admissible to take any account of previous nervous breakdown, as a criterion which may have been used diagnostically, the frequencies in the three groups become : 1. 25, 31 ; 2. 52, 109 ; 3. 17, 114. The χ^2 of this distribution is 24·21, which is still far beyond even a 0·001 level of probability for two degrees of freedom.

Diagnosis	Inhibited sex life	Poor intelligence	Bad early home life	Positive family history	Neurotic childhood	Previous nervous breakdown	Abnormal personality	Personality traits: Obsessional	Anxious	Hysterical	Unstable mood	Hypochondriacal	Paranoid	Impulsive	Unsociable	Anergic	No precipitation	Prolonged duration	Symptoms: Obsessional	Anxious	Hysterical	Depressive	Hypochondriacal	Paranoid	Specific
Military stress ..	−	−		−	−	−	−				−	−			−	−	−	−	−	+	+		−		−
Organic syndromes	−	−	−	−	−	−	−	−	−	−	−	−			−	−			−	−	−	−			+
Mental defect ..	+	+				−		−			−				−		+	+			+				+
Endogenous states :																									
Epileptic ..		+				−			−	−		−					+	+		−		−	−		+
Schizophrenic ..							+			−			+		+		+			−	−		−	+	+
Affective ..		−			−	+		+	−	−	+					−			−		−	+			+
Reactive states :																									
Depressive ..		−						+		−	+			−				−	+		−	+			
Anxious ..									+	−				−			−	−	−	+		+		−	−
Hysterical ..		+						−		+	−				−						+	−	+		−
Psychopathic personality ..	+		+	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Bad outcome ..		+	+	+	+		+	+	+				+			+	+	+	+				+		

Significant positive and negative associations between precipitation by military stress, diagnosis and outcome, and clinical features.

TABLE 9.

Boarding Category

Analysis by results is usually a most profitable method of attack. Unfortunately in this material analysis by follow-up record did not provide figures of interest, as the numbers in individual groupings were too small to give statistically significant differences. In any case a detailed attack along these lines has already been published (Lewis and Slater, 1942). Larger numbers were available for analysis by boarding category, i.e. mode of disposal. Nonconformity of confession, non-commissioned rank, normal childhood history, good school record, previous army service, satisfactory home life, breakdown occurring under military stress or with other adequate precipitation or with head injury, short duration of illness and treatment by psychotherapy are associated with a better than average chance of return to duty; whereas the opposite was true of asthenic habitus, positive family history, neurosis in childhood, certain abnormal personality traits, poor intelligence, unsatisfactory home circumstances, and a duration of illness exceeding two years.

PROPORTION OF MEN RETURNED TO DUTY

	Better than average	Worse than average
General average	24·1	
Religion : Nonconformists	32·8	—
Rank : Non-commissioned officers	37·3	—
Habitus : Asthenic	—	18·7
Positive family history	—	19·6
Childhood : Neurotic	—	12·4
Normal	38·9	—
Personality : Abnormal	—	13·9
Traits : Obsessional	—	18·1
Anxious	—	15·2
Paranoid	—	16·5
Anergic	—	15·7
School record : Poor	—	18·7
Good	34·1	—
Poor intelligence	—	17·6
Previous army service	29·9	—
Bad early home life	—	15·7
Bad relationship to father	—	14·7
Present home life : Unsatisfactory	—	16·9
Satisfactory	28·1	—
Precipitation : Positive	31·4	—
Severe military stress	33·1	—
Head injury	30·7	—
Duration : Over 24 months	—	14·9
Less than 1 month	47·2	—
Symptoms : Obsessional	—	13·6
Treatment : Psychotherapy	39·5	—

In this table only significant differences are recorded.

TABLE 10.

It can justifiably be contended that the mode of disposal reflects rather the factors that influence the clinician than those that actually are of prognostic significance. Such a criticism can, however, be pressed too far. The clinician judges a man on total impressions, rather than on items of information. Such a quality as, for instance, Nonconformist persuasion must correspond to an aspect of character and not be in itself a factor that influences a clinical view in any direction whatsoever. The fact that Nonconformists were returned to duty with a frequency significantly greater than the average is fairly surely due to a greater frequency among them of a type of personality that takes religion, and probably also personal and social duties, more seriously than the average man, and is perhaps more imbued with a degree of conscientiousness and dourness of personality. In the same way it is very unlikely that the occurrence of head injury at some time in the history has operated with clinicians as an indication of suitability of return to duty. Its association with a high rate of return is probably because in the presence of an organic factor there need not be the same degree of constitutional instability to bring about breakdown, and it is the clinical impression of the underlying instability that decides disposal.

It is of interest that patients treated by psychotherapy were more frequently returned to the army than others. *Post hoc sed non propter hoc*. The good rate of return is more likely to be connected with the type of patient chosen for psychotherapy than with the effects of the treatment itself. Very few would be chosen for psychotherapy who obviously had no chance of return to the army; this would not apply to other, less time-consuming methods.

The only other exogenic factor of prognostic importance is the circumstances of home life. It was frequently found that if there were difficulties or sources of worry here it was almost impossible to rid the patient of the notion that he would be better at home to look after affairs himself; only in rare cases was it possible to clear up the unfavourable home situation from the hospital. The nature of these home worries was seldom financial; illness of a relative, often the obviously neurotic illness of the wife, was more frequent. Other usual worries were damage to the home in air-raids and resulting dislocation of home life, and fears on the part of the soldier that his wife was being unfaithful to him.

In general, the factors which seem to be associated with eventual disposal are constitutional ones. Neurotic childhood, obsessional symptoms, abnormal personality are of particularly bad omen. It was possible to return to the army more than three times as many patients with normal childhood history as those with a neurotic childhood. Nearly half the patients whose illness had lasted less than a month could be returned to duty; where the illness had lasted longer than 24 months, only a seventh. The favourable and unfavourable features recorded here are very similar to those noted as of prognostic significance in a follow-up study of soldiers returned to duty. Lewis and Slater (1942) found that positive family history, unsatisfactory work record, psychopathic traits of personality, long duration of symptoms, lack of definite precipitating factor, resentment of army life, a paranoid attitude, querulous hypochondriasis, and the occurrence of fugue or amnesia, were all associated with an unfavourable follow-up history. This indicates that on the whole the actual symptoms manifested are of

less prognostic significance than the indications of constitutional instability.

Military Stress

This table classifies the patients into three groups of graded resistiveness to psychological and physical stress, and the usual signs of constitutional abnormality are associated with the least degree of resistance. It is a striking thing how the frequencies of different findings in the three groups make a graduated scale, severe, moderate and trifling degrees of stress balancing mild, moderate and severe degrees of constitutional abnormality. The relationship is clearly a quantitative one. Certain other points of interest also appear.

MILITARY STRESS UNDERGONE.

	Severe	Moderate	Trifling
	%	%	%
Number recorded	386	368	950
Occupation : Semi-skilled ..	44·3	43·8	35·6
Sedentary ..	14·0	16·6	21·3
Rank : Non-commissioned officers	24·1	21·7	16·7
Habitus : Asthenic	37·5	41·9	54·9
Athletic	33·5	33·8	25·2
Pyknic	29·0	24·2	19·8
Inhibited sex life	33·1	34·6	47·8
Positive family history ..	45·1	56·0	57·2
Neurotic childhood	14·8	24·7	28·4
Previous nervous breakdown	16·6	23·4	25·6
Abnormal personality ..	33·9	42·4	48·9
Personality traits :			
Depressive	29·2	33·2	34·8
Hypochondriacal	3·6	7·6	8·0
Unsociable	26·4	26·6	33·8
Anergic	14·2	24·2	26·1
School record : Poor	19·9	26·1	32·0
Intelligence : Poor	25·0	28·1	38·8
Average ..	67·2	62·0	50·6
Good	7·8	9·9	10·5
Previous army service ..	53·9	44·6	31·7
Previous war service	17·4	12·8	11·6
Unsatisfactory home life ..	10·6	13·0	14·9
Symptoms : Obsessional ..	2·3	3·5	4·0
Anxiety	80·8	73·4	46·4
Hysteria ..	47·4	38·3	35·3
Amnesia ..	31·3	16·6	16·2
Hypochondriacal	37·6	35·6	44·4
Scrimshanking ..	3·4	4·9	18·6
Treatment : Non-specific ..	30·2	52·1	64·8
Physical measures	43·9	30·1	16·3
Psychotherapy ..	25·9	17·8	18·9
Result :			
Slight or no improvement ..	46·3	52·5	72·4
Greal improvement ..	38·0	38·1	18·5
Recovery	15·8	9·4	9·1

Observations all show a significant difference between two at least of the groups.

TABLE 11.

The relationship of intelligence to stress needed for breakdown, and to outcome (Table 11), is peculiar. In the group of men who broke down under severe stress there is a preponderance of persons of average intelligence, whereas men of poor and of superior intelligence show a relative concentration in the no-stress group. Similarly men of the semi-skilled occupations broke down most frequently under severe stress, those of sedentary occupations under trifling stress. From Table 10 it can be seen that a poor school record and poor intelligence are unfavourable factors ; a good school record is a favourable factor, but not superior intelligence. The interpretation seems to be that men of substantially better than average intelligence are not likely to be happily placed in the ranks, unless employed in a specialist capacity, or otherwise doing more intelligent work than falls to the lot of the ranker or even the lower grades of N.C.O. At the time when these patients were being dealt with there did not yet exist facilities for dealing with these " round pegs in square holes."

Interesting differences in symptomatology show themselves in the three groups of Table 11. Obsessional and hypochondriacal symptoms and the tendency to scrimshanking are found for preference in the no-stress group ; military stress has a special tendency to produce anxiety symptoms, hysteria, and particularly amnesia. More active forms of therapy were necessary in the stress groups, and a better rate of return to duty was obtained ; we are not in a position to know whether this better result was maintained on follow-up.

The men who went through severe stress represent a selection for greater constitutional stability, but the signs of a neurotic make-up are still to be found (e.g. 45 per cent. had a positive family history). They had nearly all been involved in fighting and aerial bombardment in France, and had gone through a long retreat with prolonged physical exertion before reaching the beaches in the neighbourhood of Dunkirk. But only about half of them were admitted to this hospital immediately or shortly after this experience, and the rest dribbled into the wards through the succeeding months, some over a year later, having tried in the interval to carry on in their units under difficulties. These later cases proved difficult to treat and could seldom be returned to duty. By the time of their admission, their unpleasant symptoms had become so firmly connected in their minds with their life in the Army that treatment to be successful was hardly possible without a hopeful prospect of invaliding in view. These " conditioning " mechanisms were very frequent in our patients, but were not easily subjected to statistical analysis.

The Structure of the Neuroses

Table 9 represents in a highly compressed form the main results of our investigation. We note that the organic syndromes score figures significantly less than the average with great regularity, and in this respect show a parallel with states precipitated by military stress. This is presumably because both groups correspond more nearly than the average of our material to a normal, i.e. healthy, population, in the extent to which they are burdened with the signs of constitutional predisposition. At the other end of the table will be found the psychopaths and the patients whose illness had a bad eventual outcome, either in invaliding or a later repeated breakdown ; both these groups show figures significantly

greater than the average. They represent therefore the other extreme of greatest abnormality. These two associations provide ground for the hypothesis that the tendency towards failure and breakdown has to be regarded quantitatively. In some persons, though it exists, it is small and needs considerable stress for its manifestation ; in others it is stronger, is manifested on slight stress, and is not so readily susceptible to treatment or manipulation of the environment.

Organic, endogenous and neurotic states offer contrasts one with another. An organic disability depends on the nature, severity and site of incidence of the exogenic factor ; its primary effects are to a large extent independent of the individual constitution. On the basis of the organic injury there may then be added a neurotic disability, whose nature will be largely predictable from knowledge of the constitution, gathered from previous and family history. But the organic and the neurotic symptoms will be clinically distinguishable one from another. Further, the organic injury may itself predispose to neurosis, which will occur in its presence with a lesser intensity of constitutional instability than otherwise necessary. In the endogenous states (schizophrenia, cyclothymia, idiopathic epilepsy, obsessional " neurosis ") the hereditary disposition is all-important ; the manifest state does not occur in its absence, and none or only non-specific stimuli may be needed for its release. As with the organic states, neurotic features may be added but will be clinically distinguishable from the specific symptoms of the primary condition.

The neuroses and psychopathies show a more fluid state of affairs. The form of the exogenous stress is more important than in the endogenous states (e.g. military stress—anxiety), but far less so than in the organic states. But the form of the reaction is still principally determined by constitutional predisposition, and there are strong correlations between the make-up of the personality and the symptoms exhibited (see under). There are only a limited number of main types of reaction available—anxiety, hysteria, depression, hypochondriasis, etc.—and if neurotic breakdown occurs it will be along one of these lines, or more than one simultaneously. In the neurotic states there are no symptoms that compare in specificity with the retardation or the phasic change of mood of the manic-depressive, with the primary delusion or the thought disorder of the schizophrenic, or the neurological manifestations of the epileptic. Whereas endogenous states once initiated run their course largely independently of environmental influences (other than such deeply reaching ones as insulin coma, convulsion and leucotomy), the neurotic states are comparatively readily reversible and recur as readily as they are relieved. The neurotic states appear indeed to be forms of behaviour, frequently mere exacerbations of a type of response characteristic of the individual.

It is of interest here to enquire into the degree of association of particular personality traits with their corresponding symptoms. Taking a random group of 400 of our case-records, the following tetrachoric correlation coefficients have been calculated.*

1. OBSESSIONAL.—*Trait :* Over-conscientiousness, caution, tendencies to doubt and re-checking, pernickety orderliness, devotion to duty, rigidity and unadaptability, etc. *Symptom :* Compulsive thoughts or actions, with insight, and resisted by the personality. $r = +0{\cdot}76$

2. HYSTERICAL.—*Trait :* Egocentricity, emotional dependence on others, excitability, superficial emotionality, self-satisfaction, demonstrativeness, desire for attention, vanity, love of show, etc. *Symptom :* Conversion symptoms, or a markedly hysterical attitude to the illness. $r = +0{\cdot}51$

3. PARANOID.—*Trait :* Sensitiveness to imagined hostility, tendency to resentment and disgruntlement, self-consciousness, suspiciousness, etc. *Symptom:* Suspicion of or hostility to physician, ideas of reference or delusions. $r = +0{\cdot}50$

4. ANXIOUS.—*Trait :* inferiority feelings, self-distrustfulness, fear of trouble, timidity, ready embarrassment, tendency to worry, etc. *Symptoms :* Somatic anxiety, tremor, palpitation, tachycardia, sweating, tension, nightmares, prevailing mood of fear, etc. $r = +0{\cdot}40$

5. DEPRESSIVE.—*Trait :* Ready pessimism or elation on trifling cause, moodiness, tendency for an upset in mood to persist unduly, etc. *Symptom :* Observed mood change of considerable duration. $r = +0{\cdot}39$

6. HYPOCHONDRIACAL.—*Trait :* Preoccupation with bodily health, with bowel regularity, interest in physical exercises and get-fit schemes, fondness for patent medicines, etc. *Symptom :* Tendency towards somatic localisation of symptom and preoccupation with physical aspect of illness. $r = +0{\cdot}19$

These findings indicate that of all neurotic symptoms obsessional symptoms are most firmly rooted in a basis of specific predisposition, the next in order being hysterical and paranoid symptomatology. Depressive and anxious symptoms are distinctly less closely related to the endogenous predisposition, and hypochondriasis, at least as here defined, least of all. It is true that the constitutional disposition can nowhere be excluded, and its importance in anxiety and depressive states of all kinds is considerable. But hypochondriacal, depressive and anxious symptoms seem to be of all neurotic symptoms those most directly related to exogenic factors and those which can be most reasonably regarded as a general human weakness. The finding agrees with our preconceptions ; under certain circumstances it would be abnormal not to be afraid, or depressed, or somewhat preoccupied with bodily processes.

It is to be admitted that this account of the structure of the neuroses leaves important factors out of the picture and provides a very inadequate theory for developmental purposes. It seems fairly clear that processes resembling conditioning occur in man as well as in experimental animals, and that neurotic states have their own dynamics. Our experience suggests that in the predisposed individual such reactive dispositions can be established with great rapidity. A man's experience of dive-bombing did not have to be very prolonged for the association in his mind of certain types of noise and a fear-pro-

* I am indebted to my brother, Patrick Slater, for much valuable advice on the statistical methods employed from here on.

ducing situation to become firmly fixed ; and for a long time after similar sounds, though recognized as harmless, would continue to produce the physiological and mental changes typical of fear. The disposition once established was difficult to break up, and even when it had apparently passed off was easily re-established. If this effect can occur so easily in the adult, there is plausibility in the view that the plastic mind of the child is even more susceptible.

The hypothesis presented here is, then, that neurosis represents a special case of a generalized type of behaviour, and signifies a failure of adaptation. The two primary reagents are the individual constitution and the environmental set-up of the moment. The individual constitution is in greater part determined by hereditary factors, to a lesser degree by environmental circumstances of the past producing their effects by organic lesion and psychological and physiological conditioning. These factors, especially the first, determine the form and the severity of the congeries of symptoms, which are the so-called neurotic states or neuroses. The momentary environment determines the time of manifestation, and to a lesser extent the severity and even the form of the symptoms (e.g. the association of military stress and anxiety). Other factors, such as physical illness or physiological upset and intellectual incapacity, can have an adjuvant effect, and may also influence the form of the reaction (e.g. mental defect in favouring hysterical manifestations, physical illness in favouring hypochondriasis).

On this view obsessional neurosis should be excluded from the other neuroses as more closely resembling in nature the endogenous psychoses. The syndrome called "psychopathic personality", on the other hand, though no doubt it includes types of abnormality of personality closely related to the psychoses, is otherwise an extremer form of the neurotic constitution, in which socially obnoxious or partially incapacitating symptoms are exhibited at all times, even when there is no perceptible degree of stress in the environment. There is little to be said for the convention by which certain traits, such as aggressiveness and asocial tendencies, are regarded as psychopathic, whereas tendencies towards anxiety, instability of mood, dissociation, etc., are regarded as neurotic. If we wish to introduce system and reason into our nomenclature it will be necessary to discover further traits showing the degree of specificity and independence that obsessionality seems to show, to work out their degree of specificity and independence from or association with other such traits, and then to rank personalities both horizontally and vertically by the specific traits they show and the degree to which they show them. The clinically convenient distinction as to whether an individual is subjectively and objectively ill or not appears to be only a crude quantitative measure, and of secondary biological importance.

We can now attempt a check on theory by observed fact. Positive family history, childhood neurosis, poor work record, repetition of nervous breakdown, abnormal personality make-up judged clinically, poor intelligence, are severally independent observations, touch different aspects of the life of the individual, have been shown to have relevance to outcome and prognosis, and can be taken as crude measures of the neurotic constitution and inadequate intellectual endowment. Neurotic constitution and inadequate intellectual endowment are held to be the two most important predisposing factors for the manifestation of neurotic breakdown. The frequencies of association in one and the same patient of these several observations have been counted in 1,600 records (i.e. omitting 400 records blemished by too many queries or unanswered questions), and the corresponding tetrachoric correlation coefficients are listed in Table 12.

From this table it can be calculated that 91·7 per cent. of the total variance can be accounted for by the first factor loadings 1–6 and the second factor loadings 3 and 6 ; i.e. our double hypothesis of a neurotic constitution and poor intelligence as the main cause of the observations recorded accounts for all but 9·3 per cent. of our observations. Within the limits of the statistical method employed and of the errors, which are probably considerable, of our original observations, this must be regarded as satisfactory agreement.

In Table 12 the factor loadings, which when multiplied by one another provide the individual correlation coefficients, indicate the extent to which the various findings are good tests of the underlying constitution. The best indicators of the neurotic constitution are, in order, clinically abnormal per-

Diagnosis	Correlation coefficients						Factor loadings	
	1	2	3	4	5	6	"Neurotic Constitution"	"Inadequate intelligence"
1. Positive family history		0·4521	0·1874	0·1716	0·4304	0·1368	0·5928	−0·0534
2. Childhood neurosis ..	0·0613		0·2870	0·0961	0·5644	0·1487	0·6617	0·0284
3. Poor work record ..	0·0375	0·0155		0·1212	0·4587	0·4061	0·4321	0·5857
4. Previous nervous breakdown ..	0·0302	−0·0542	0·0714		0·2245	−0·0578	0·2308	−0·0853
5. Abnormal personality	−0·0472	0·0215	0·0408	0·0458		0·1482	0·8157	0·1119
6. Poor intelligence ..	0·0816	0·0439	−0·0593	−0·0477	−0·0187		0·1374	0·4908

Observed correlation coefficients are given to the top and to the right ; second residuals, after partialling out the first and second factor loadings, to the bottom and to the left.

TABLE 12

sonality, neurosis in childhood, positive family history, poor work record ; repeated nervous breakdown, a quality associated particularly with cyclothymia, and poor intelligence show but low correlations. A poor work record and poor intelligence as judged clinically are good tests of inadequate intelligence, but the other observations are no measures at all. Poor work record is, then, a good test of both types of inadequacy and should obviously have considerable attention paid to it clinically. The finding of greatest theoretical importance brought out by the table is that neurotic constitution and inadequate intelligence operate independently, and are clearly aetiological factors in their own right.

The neurotic constitution is then a useful hypothesis, and one which ranks with inadequate intelligence in accounting for social insufficiency, breakdown and impairment of efficiency for military duties. It is interesting to compare these two biological handicaps one with the other. We know that intelligence is practically solely determined by genetic factors ; our evidence suggests that the same may be true of the neurotic constitution. We know that the genetic determinants of intelligence must be numerous, and that they operate cumulatively, so that in a random sample of the community rated by measures of intelligence one finds a normal curve of frequency. There is no reason to think that the same would not be true of temperamental qualities, were we able to develop independent psychometric tests of the intensity of neurotic tendencies. It is clear that people can be more and less neurotic as they can be more and less intelligent. But there is an important practical difference. For whereas differences of degree of intelligence are much more striking than differences of quality, the opposite is true of neurosis, when we are more struck by differences of quality than of degree. Qualitative differences of intelligence and quantitative differences in neurosis have so far received little attention ; the time will come when attack will have to be made along both these lines.

References

Cameron, K. (1940). *Lancet*, **2**, 659.
Curran, D. (1937). *Lancet*, **2**, 1005.
Debenham, G., D. Hill, W. Sargant, and E. Slater (1941). *Lancet*, **1**, 107.
Hadfield, J. A. (1942). *Brit. Med. J.*, **1**, 281 and 320.
Halstead, H. (1943). *J. ment. Sci.*, **89**, 202.
Hubert, W. H. de B. (1941). *Lancet*, **1**, 306.
Lewis, A., and E. Slater (1942). *Lancet*, **1**, 496.
Luxenburger, H. (1933). *Eugenik*, 3.
Sargant, W. (1942). *Brit. med. J.*, **2**, 574.
Sargant, W., and E. Slater (1941). *Lancet*, **2**, 212.
Sargant, W., and E. Slater (1940). *Lancet*, **2**, 1.
Sargant, W., and E. Slater (1941). *Soc. Med.*, **34**, 757.

THE PSYCHO-SOMATIC SYNDROME OF SPURIOUS PREGNANCY AFTER THE MENOPAUSE

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Spurious pregnancy (false pregnancy or pseudocyesis) constitutes a subject of considerable practical importance not only for the general practitioner and obstetrician but also for the psychiatrist, as it presents one of the most impressive examples of the influence of emotional mechanisms on physical processes.

The occurrence of this condition in humans and animals has attracted attention throughout the ages, one of the earliest descriptions being found in the writings of Hippocrates. Paddock, who in 1928 made a survey of the literature on that subject viewed from the obstetric aspect, quotes various authors, among them James Y. Simpson and Montgomery (1863). The psychological significance of the syndrome, however, has not received adequate attention. While some authors maintain that pseudocyesis is found mainly in women of the 25–35 age period, Simpson and Montgomery emphasize its more frequent association with the climacteric period. Paddock maintains that most of the cases reported were young women. He regards false pregnancy at the climacteric as part of the general menopausal syndrome. Maranon (1929) supports Simpson and Montgomery in their view that the frequency of the condition is highest at the climacteric and classifies the condition as a metabolic disturbance originating from emotional causes. "In women whose desire to remain young makes them forget how old they are . . . it is striking to note how the suppression of the menses coincides with a general increase in the size of the abdomen." He states that the condition may be due to an unfulfilled desire to have children or to an effort at self-deception that sexual power may not yet be lost. Schwarz (1933) states that pseudocyesis tends to occur mainly in women with a premature menopause. From the psychiatric point of view, Kehrer (1928) has recently surveyed the literature and reported on his own observations. He says that the supposition of pregnancy may be the outstanding delusion in a psychosis and that in many instances mental phenomena may be present in a marked degree even in the absence of bodily changes. The most recent review of the literature has been contributed by Moulton (1942).

Those authors who have stressed the psychopathological implications of the condition have been satisfied in attributing it to wish fulfilment. The discrepancy, however, between the number of cases with a strong desire for pregnancy and those actually presenting signs of pseudocyesis makes it clear that wish fulfilment can result in the production of this particular psycho-somatic syndrome only under certain conditions, still to be defined.

The following case represents a contribution to the understanding of some of those conditions.

Mrs. E. S. aet. 53 was admitted on 24th September 1941. *Family history :* The mother, to whom the patient was unduly attached, is described as a quiet, sympathetic woman with a deeply religious outlook. She was a midwife of repute. The father, who was 13 years older than his wife, died when the patient was 7 years of age. No nervous or mental illness has been reported in the family. *Personal history :* The patient was the only child. She describes her early childhood as happy ; but she was always solitary and introspective. So strong was her attachment to her mother that she disliked leaving home to go to school. She recalls scenes when she wept at the very thought of leaving her mother and she found it difficult to mix with other children, her contact with her schoolmates being entirely superficial. Occasionally she suffered from "bilious turns," during which she enjoyed a sense of pleasure and satisfaction because she could remain beside her mother and have her special care and attention. She was obsessed with the idea that she was different from her friends and became progressively more dependent on her mother, the only person in whom she could confide and from whom she could derive comfort and encouragement. The menarche occurred at the age of 13½ ; menstruation was irregular until the age of 18 when a normal cycle was established. According to herself, she was small and under-developed until the age of 18, when she began to develop normally and her outlook became less solitary and dependent.

At the age of 19½ she married, her husband being 12 years older then herself. She says that because of his age she was less afraid of him than of most other men and that he gave her a feeling of protection akin to that which she had come to associate only with her mother. That feeling of dependence remained a prominent feature of her relationship to him. Her attitude towards the physical side of marriage was always immature ; she was frigid and constantly harboured a fear of becoming pregnant. This fear was fostered by her mother who thought childbirth undesirable for her daughter because of her delicate childhood. Consequently the patient submitted to intercourse only infrequently, and then only when coitus interruptus was practised. Only in the 13th year of their marriage did normal intercourse take place on a few occasions and it was then that she became pregnant. Even now she complains that her husband took advantage of her and that the pregnancy should never have occurred. Throughout the pregnancy she

was unhappy and fearful, she had persistent hyperemesis, lost her appetite and on several occasions during the latter 3 months visited her doctor in a state of extreme agitation because she had ceased to feel life. She kept saying that something dreadful was going to happen. Her physical condition was poor at the time of delivery, labour lasted for 2 days and was preceeded by 3 panic attacks, during which she was very agitated and maintained that labour had commenced. Inertia persisted throughout the labour and the patient was quite uncooperative. A forceps delivery was performed and the baby, a girl, was stillborn. The puerperium was characterized by apathy and lack of initiative and her recovery was very gradual. Information received from a friend suggests that she had a melancholic depression at this time. She became more shy and secretive and the doctor advised the husband that the patient should have another child. She became pregnant 2 years later. Though she had the same fears and apprehensions as in the first pregnancy, her physical condition was satisfactory and hyperemesis much less persistent. The labour, like the first, was complicated by inertia but delivery was spontaneous and this child, a boy, was alive. She made a good recovery, took an interest in the child and became very devoted to him. She remained as reticent as ever with strangers, but in the home she was less quiet and secretive. Her whole life had obviously been made much happier by the arrival of the baby. Four years later, however, when her husband developed phthisis, she reverted to her former anxious state with its inhibitions and feelings of inadequacy. After his death 6 months later, she made her home with her mother as she had done before her marriage. She made a good adjustment to this life and was contented and happy until the death of her mother 2 years prior to admission. She became very depressed and felt that a part of herself had died with her mother. She lost all initiative, took no interest in anything, had no appetite, slept badly and could see no hope for her son or herself. While she was in this depressed condition, the incident occurred which, according to her, was responsible for her " pregnancy." In March, 1941, an old schoolfriend, who was in the habit of visiting her home, " ravaged her in her grief." The vague manner in which she recounts the story makes it seem very doubtful whether that incident actually occurred. Previous to the alleged rape, her periods had become very irregular and they ceased altogether thereafter. At that time her depression became more profound and was aggravated still further by the fear of separation from her son who had become eligible for military service. When no further periods occurred, she developed the idea that she was pregnant. She blamed herself for the sin she had committed and contemplated suicide. She rejected all the assurances from her doctor that no pregnancy existed and after a further six weeks she maintained that she felt life. Her depression and agitation became so marked that she had to be admitted to this hospital as a certified patient.

Condition on admission.—The patient was depressed and agitated. Her first question was whether she could be taken to a maternity hospital lest the baby should arrive very soon. She was concerned about whether the necessary facilities for childbirth were available here. Though she expressed the fear that she might die during labour, her main worry seemed to be concerned with what the neighbours at home might say of her. In particular she was worried lest they might believe that her son was the father of the child. She gave a very suggestive history of her symptoms usually associated with pregnancy : morning sickness, frequency, pains in the breasts, discharge from the nipples, quickening at the 14th week, pain at the small of the back and discomfort when walking. She said that lately her abdomen had been enlarging. . . . She was in a state of utter despair and repeatedly blamed herself for the disgrace she had brought upon herself and her son, saying that if her mother had been alive all this would never have happened. She slept badly, resisted feeding, talked only about her " pregnancy " and kept on asking other patients whether she would be all right.

Physical Examination.—Her abdomen was distended and firm, the swelling reaching the level of the umbilicus. In shape it was broader than that found in pregnancy, no foetal parts could be felt and no foetal heart could be located. She could simulate foetal movements by contracting and relaxing the abdominal muscles. No dullness could be elicited on percussion, the note being hypertympanitic all over, suggesting the condition of meteorism. The breasts were full and enlarged and from the nipple a serous secretion could be expressed. Vaginal examination revealed no evidence of pregnancy. The cervix was elongated and lacerated, the scar causing marked puckering of the edges. There was some laxity of the pelvic floor and the perineum was deficient. The uterus, however, was in good position, quite mobile, and of normal size. The appendages were palpable on both sides and the right ovary was very slightly enlarged. The Aschheim-Zondek Reaction was performed and the result was weakly positive. Two weeks later this was repeated with a negative result.

At first, repeated reassurances that she was not pregnant did not have the slightest effect. She was treated by psychotherapy and although she was very unco-operative in the initial stages, she was later more readily influenced. She began to talk more freely about herself, said she had wanted to have another child, that she had never got over the disappointment of the stillbirth, and that even the birth of her son had not compensated her for the loss of the daughter. About six weeks after admission, she admitted that she was not pregnant, and her depression gave way to a state of comparative contentment. Nevertheless, the physical signs simulating pregnancy persisted ; but a week later the abdomen " deflated " overnight, the breast secretion ceased and the Aschheim-Zondek Reaction gave a normal result. During this remission, she was examined by Professor R. W. Johnstone, who recommended that a plastic operation be performed to repair the pelvic floor. This was done on 22nd December, 1941, with a very good result. She was reassured about her pelvic condition at the time of the operation and she was quite convinced that there had been no pregnancy whatsoever. At the same time, she volunteered the information that her illness might have been due to the great disappointment she had suffered at the time of the stillbirth. She remained well until early March, when she again became depressed, saying that the baby was almost due. This episode, however, lasted for only two weeks and she was readily persuaded that no pregnancy was present. At that time, the delusion was associated with none of the symptoms or physical signs of pregnancy. After two months remission she was found to have hidden a brick and a piece of rope in a cupboard with suicidal intent. Her depression had returned and she was obsessed with the idea that there was a tumour in her abdomen. This delusion soon reverted into the idea of pregnancy and impending labour without any of the previous physical manifestations. The associated depression and agitation had also recurred.

30th September, 1942. The patient has been given a course of electro-convulsant therapy, consisting of seven treatments, during the past three weeks. After the second treatment, she lost the idea of pregnancy, but was still depressed. After the fourth treatment, the depression was replaced by a state of contentment and by the end of the course, the patient had become slightly euphoric. The idea of pregnancy has not recurred—April, 1943. The patient was discharged on 22nd March, 1943. She has completely recovered.

Summary

This is the case of a widow of 53 who, at the time of the cessation of menstruation, expressed the idea that she was pregnant, attributing conception to an alleged rape. Her general mental condition

was that of an involutional depression which had been precipitated by the death of her mother and her whole emotional life was centred round the supposed pregnancy. On admission she presented the typical signs of pseudocyesis including positive hormonal reactions. These signs, however, disappeared in the 8th month of the alleged pregnancy and have not recurred. The disappearance of these signs coincided with a complete remission of her mental condition which was, however, only temporary. With a subsequent relapse into her previous depression, the idea of pregnancy recurred. The previous personality was characterised by neurotic trends with features of anxiety and an unduly strong mother fixation which the patient has never been able to resolve. She remained psychosexually immature, was frigid and could never establish a normal relationship to her husband. Her attitude towards her previous pregnancies was that of fear and aversion throughout her reproductive period. Her first pregnancy, occurring 13 years after marriage, resulted in a stillbirth and was followed by an abnormal mental reaction, suggestive of a melancholic depression. Two years later, she gave birth to a normal child. Both pregnancies were complicated by hyperemesis and abnormal anxiety reactions, while both labours were inert. When she was widowed 4 years after the birth of her second child, she returned to her mother's home. The death of her mother 2 years previous to admission was followed by a severe depressive reaction with melancholic features. This depression persisted until the delusion of pregnancy developed. The fear of separation from her son constituted an additional source of apprehension.

Comment

This patient belongs to the group of cases developing false pregnancy during the climacteric period ; the cessation of menstrual functions was certainly one of the precipitating factors in the development of the syndrome. The idea of pregnancy occurred while she was still mourning the loss of her mother and dreading the impending separation from her son. The delusion developed on the background of an involutional depression and her entire emotional life became absorbed in the idea of pregnancy. Her conscious attitude towards that pregnancy was one of fear and guilt, but it was evident that at the same time the pregnancy satisfied a strong subconscious desire. In one of her remissions when she had regained insight, the patient explained her delusion on the basis of a compensation for the disappointment she had suffered by the stillbirth of her first child. It is noteworthy that the attitude of this patient towards pregnancy and childbirth during her active reproductive period had been characterized by aversion and anxiety, and this attitude was obviously responsible for the complications—hyperemesis, false labours, inertia, and puerperal depression. Further, it is not beyond possibility that the inertia, which was of obvious nervous origin, may have contributed to the death of the first child during delivery. The development of a melancholic reaction after the stillbirth is of special interest in view of the results of a recent investigation into the ætiology of such psychoses carried out by the author in this hospital. It has been shown that these conditions tend to be of the depressive type and that strong aversion or ambivalence towards pregnancy can usually be demonstrated. It is probable that the conscious aversion which this patient had shown towards pregnancy in the past originated partly in her neurotic trends resulting in psychosexual immaturity, and partly in the fact that her mother, with whom the patient had identified herself all her life, had discouraged her from having children. This latter circumstance must have had a profound effect on the patient who had never succeeded in resolving her mother fixation. Her whole history bears out the tendency to subordinate herself to her mother, and it is interesting to note that it was not until after the mother's death, which coincided with the end of her own reproductive period, that the imaginary rape occurred. It is likely that her abnormal mother fixation had been responsible for the sexual repression which had characterized her life throughout the active reproductive phase, and that the ideas of rape and pregnancy were the products of a compensatory mechanism. It is characteristic not only of her personality type but also of the depressive condition she presented that she reacted with a strong sense of guilt to those ideas. It is noteworthy that she expressed a fear of being suspected of an incestuous relationship with her son.—The complete psychosomatic syndrome of pseudocyesis presented in this case persisted only for the first 8 months of her illness and thereafter physical signs have been absent even when the idea of pregnancy has recurred. The appearance of those signs can be interpreted as a last effort on the part of the reproductive system while it is still capable of responding to stimulation. From the psychiatric point of view it would not be reasonable to regard the disappearance of those physical signs as the resolution of the condition of spurious pregnancy. It seems appropriate to describe false pregnancy as a psycho-somatic syndrome which may be either complete or merely abortive. In some cases the physical symptoms are of primitive nature only, while the full psychological syndrome is present ; in other cases, particularly in younger women, the emphasis is laid on physical signs of the syndrome, while the mental components remain more latent.

The following case shows the typical psychological syndrome of false pregnancy with only abortive physical signs.

Mrs. E. B. aet. 53, admitted on 13th July, 1942. *Family history* was negative for nervous and mental illness. She had always been well exteriorized and there was nothing unusual in her relationship to her parents. She was married when she was 28, but she felt no real affection for her husband. She has always been frigid. Of her 4 pregnancies, the first and third resulted in early miscarriages. Her first child died at the age of 3 and the second child, a daughter, is alive and healthy. Her family life was fairly happy until 10 years ago, when she

felt an increasing aversion to sexual intercourse. Later her husband became an alcoholic and he died from pneumonia in March 1942. During recent years she had become progressively more jealous and suspicious. Her menstrual periods had ceased suddenly at the age of 35 for no known reason (the only abnormality to be found at that time was an extreme retroversion of the uterus). After the death of her husband, her increasing irritability and paranoid attitude towards her environment made her admission to this hospital necessary. When she was examined for certification, she expressed for the first time the belief that she was pregnant.

Condition on admission.—The patient was in a state of mild elation, she was fully orientated and did not mind being brought to hospital. The whole thought content was taken up with her supposed pregnancy. She said that the film star Clark Gable had made her pregnant " through an automatic." She denied having had intercourse with him, said that she had met him before she had met her husband and that he was in love with her but that she was not in love with him, and that she had refused to marry him. Through the same " automatic " she heard the voice of Clark Gable and she maintained that through the medium of this same apparatus she was examined regularly by an eminent obstetrician who came to reassure her about the wellbeing of the baby. She was completely inaccessible to reason, maintaining that she was in the 8th month of her pregnancy and that she could feel life. When it was pointed out that she presented no physical signs of such a condition she demonstrated rhythmic contractions of the abdominal muscles which, according to her, were produced by the movement of the child. Physical examination was completely negative apart from those rhythmic movements described above. The hormonal reactions were negative.

In this case the idea of pregnancy arose on the background of a paranoia developing in the climacteric period. Death of the husband occurring previous to the appearance of that idea may have acted as a precipitating factor. This patient, like the first one reported, had been frigid during the whole of the reproductive period and she, too, had never recovered from the disappointment she had suffered through previous miscarriages. The imaginary pregnancy was attributed to a union with a fantasy hero ; even that delusional sexual relationship was characterized by frigidity and ambivalence. This patient showed no external physical signs, apart from contractions of the abdominal muscles. The lack of response on the part of the generative system may be attributable to the fact that in this case, as distinct from the other, the idea of pregnancy had occurred many years after the unusually early cessation of the ovarian activity ; it may also be due to the fact that in this case, the emotional reactions were less profound than in the first and that the patient in her delusions had completely parted from reality ; the character of the psychosis which in this case formed the background of the idea of pregnancy makes it understandable that the delusion did not take possession of the whole of the psycho-somatic personality. However, physical signs were not entirely lacking and the rhythmic movements of the abdominal muscles may be regarded as an abortive expression of the physical part of the syndrome. Such movements were also observed in the first case and both patients denied that they produced them voluntarily. It can be assumed that similar abortive physical signs of the syndrome can be found in the great majority of cases who express the idea of being pregnant after the end of the reproductive period. It is noteworthy that both patients had borne children, but in both cases " obstetric catastrophies " had acted as mental traumata in the past.

The previous history of the second case had again much in common with the histories of women who are apt to develop abnormal mental reactions to real childbirth ; the psychosexual make-up of those cases has been described by Zilboorg. This case too, suggests that it would be profitable to study all mental changes with the content of thought centred round reproduction as belonging to one large group as far as the dominant complex is concerned. The psycho-somatic syndrome of spurious pregnancy would be one of that group ; the other conditions to be studied in that context would be neurotic and psychotic reactions during pregnancy, puerperium and lactation ; certain hypochondriacal conditions occurring at the menopause and deriving the content of thought from the same complex would have to be included. It can be assumed that the idea of pregnancy in the climacteric period is, psychogenetically, the antithesis of hypochondriacal ideas associated with that age period and finding expression in complaints of hollowness, emptiness and sometimes amounting to nihilistic ideas. The existence of a psychological relationship between pregnancy and hypochondriacal complaints of this nature is borne out by the observation that such complaints frequently occur in the course of depressive mental changes following childbirth. All mental changes centred round the complex of reproduction have it in common that they are not associated with a specific mental illness, and that they occur on the background of psychoses as well as neuroses.

It is clear that the observations of the two cases presented in this article do not permit of any general conclusions regarding the aetiology of the psychosomatic syndrome of spurious pregnancy. However, it has been possible to demonstrate the complexity of the physiological and psychological factors which were operative in the production of that syndrome in the cases described. It may sometimes be difficult to trace the psychogenic factors in non-psychotic patients though the very coarse nature of that conversion symptom makes it unlikely that the underlying psychological mechanisms would remain completely hidden in the unconscious.*

Conclusions

Two cases of spurious pregnancy occurring in women after the end of the reproductive period have been described. In both cases the idea of pregnancy formed the dominant content of thought in a

* An interesting historic example of spurious pregnancy occurring towards the end of the reproductive period in a non-psychotic woman was Mary, Queen of England (1553–1557), the daughter of Henry VIII ; in her case, the overwhelming environmental influences during childhood and adult life, cooperating in the origin of the syndrome can be easily traced (*vide* J. E. Neale, *Queen Elizabeth*, London, 1934).

psychosis which in the first case was of the involutional melancholic, in the second case of the paranoid type. The prepsychotic personalities were characterized by psychosexual immaturity and there were histories of stillbirth and miscarriages which had acted as severe mental traumata. A variety of environmental factors predisposing to the formation of the idea of pregnancy could be demonstrated. The first patient had had a depressive mental reaction of the melancholic type following stillbirth. In that case physical signs and hormonal reactions suggestive of pregnancy were present for some time ; in the second case physical signs were only abortive.

Spurious pregnancy has to be regarded as a psycho-somatic syndrome, the completeness of which depends on a variety of factors, the most important being the condition of the reproductive system and the extent to which the idea takes possession of the whole personality. It has been pointed out that the previous histories of the two cases described had much in common with those found in women who develop abnormal mental reactions following childbirth. It has been suggested that the syndrome of spurious pregnancy occurring after the end of the reproductive period should be studied in the context of the whole group of mental changes associated with the functions of the reproductive system, including hypochondriacal conditions following the menopause.

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References

Jacobs, B. (1943). *J. ment. Sci.*, **89**, 242.
Kehrer, E. (1928). *Handb. Biol. Path. Weibes, Wein-Leipzig ;* **6**, 714.
Maranon, G. (1929). *The Climacteric.* London.
Montgomery, W. F. (1857). *The Signs and Symptoms of Pregnancy*, Blanchard and Lea, Philadelphia (quoted by Paddock).
Moulton, R. (1942). *Psychomat. Med.*, **4**, 376.
Paddock, R. (1928). *Amer. J. Obstet. Gynæc.*, **16**, 845.
Schwarz, O. H. (1933). *Obstetrics and Gynæcology.* London and Philadelphia. (Ed. by A. H. Curtis.) **1**, 675.
Simpson, J. Y. (1863). *Diseases of Women.* Blanchard and Lea, Philadelphia, (quoted by Paddock).
Zilboorg, G. (1931). *Amer. J. Psychiat.*, **10**, 927.

SUGGESTIBILITY AND HYSTERIA

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Introduction

The present paper is concerned with two problems which, although they may with advantage be treated separately on the theoretical level, are closely connected. The first, or clinical problem, is concerned with the relationship obtaining between hysteria and suggestibility ; the second, or psychological problem, is concerned with the nature of suggestibility, and its relation to a number of other psychological variables, such as intelligence, perseveration, and personal tempo.

The clinical problem.—In his *Major Symptons of Hysteria*, Janet (1907, p. 292) set forth a view of the relation between suggestibility and hysteria which has had a profound influence on psychiatry. He maintained that " suggestion is a precise and relatively rare phenomenon ; it presents itself experimentally or accidentally only with hystericals, and, inversely, all hystericals, when we study them from this standpoint, present this same phenomenon in a higher or lower degree. . . . The most important mental stigma of hysteria is *suggestibility*." (Janet's italics). This view was echoed by Babinski and Froment (1918), who maintained that hysteria consists in manifestations which are brought into existence by the influence of suggestion, and that the essential feature of the hysterical personality is abnormal suggestibility. The adherents of the Nancy school, while maintaining that all men are suggestible under favourable conditions, agree with Janet and Babinski in maintaining that the hysterical patient differs from the normal human being chiefly in that his suggestibility is more or less increased, owing to the prevalence of a state of cerebral dissociation (Bernheim, 1887).

While this view regarding the special relationship between suggestibility and hysteria seems to have flourished especially in France, it is by no means restricted to that country. McDougall (1911) points out that " a high degree of ' Suggestibility ' is a leading feature of hysteria " ; Jacoby (1912) speaks of " the special relationship between suggestion and hysteria," quoting Morton Prince in support ; Rosanoff (1920) quotes Babinski with approval, as does Noyes (1939). Shaffer (1936) speaking of the personality of hysterics, asserts that they tend to be more suggestible ; Morgan (1936) lists suggestibility among the most characteristic features of hysteria ; Hirschlaff (1919), Tuckey (1921), Satow (1923), Fisher (1937), Ewen (1934), Cameron (1929), and many more could be quoted in support.

While there is hardly a discordant voice in this psychiatric chorus, experimental evidence seems to be almost wholly lacking. Even the meagre results of Travis (1924, 1926) have not been confirmed by later workers (Bartlett 1935), and in any case their bearing would be only indirect. Consequently, it seemed desirable to submit this question to an experimental test, and to determine the suggestibility of a number of definitely hysterical men and women by means of a variety of tests, in order to compare their scores with those made by a number of men and women who showed no signs of hysteria whatever.

It had also been suggested, particularly by Stephenson (1934) and Cattell (1936), that a negative relation obtains between hysteria and perseveration ; consequently, two tests of perseveration were included in the battery. On *a priori* grounds it appeared possible that personal tempo might be correlated with hysteria, and accordingly this personal trait, too, was tested.

The psychological problem.—Before a trait such as suggestibility can be measured it is essential that it be proved a unitary trait. In other words, unless it can be shown that people tend to be consistently suggestible or non-suggestible in a variety of situations designed specially to measure this aspect of their personality, the very existence of this trait as a psychological mechanism must remain in doubt. Thus if it be true, as Allport (1937) suggests, that suggestibility is a generalized trait only in a very small number of people, attempts to measure it will be unsuccessful. Consequently, it will be our task to examine with special care the intercorrelations between our tests, in order to determine the generality or specificity of the trait which we are measuring.

These intercorrelations may also be useful in throwing some light on the question of group factors in suggestibility. Thus it has become customary to speak of personal or prestige suggestibility, as opposed to impersonal, non-prestige suggestibility. As tests of both personal and impersonal suggestibility were included in our battery, it will be possible to obtain definite evidence on this point.

Apart from these two questions of the unitary nature of suggestibility, and of group factors within

the general field of suggestibility, several other psychological problems arose in the course of the experiment. These include the relation between suggestibility and intelligence, perseveration, and personal tempo; the relative suggestibility of men and women; the manner in which suggestibility is distributed; the reliabilities of the various tests used, and various others which will be discussed later.

As the main purpose in this series of experiments was to test a theory most closely associated with the name of Janet (1924, p. 128), it seemed only fair that we should use his own definition of suggestibility. According to him, "suggestion is a particular reaction to certain perceptions; this reaction consists in the more or less complete activation of the tendency that has been evoked, without this activation being completed by collaboration with the whole personality." The tests used were chosen so as to conform with this definition; they will be described in the next section.

Experimental Procedure

The subjects.—The greatest care was exercised in the selection of the subjects, as the whole success of the experiment depended on the unequivocal presence or absence of hysterical symptoms, and on the elimination of any other points of difference between the two groups. Sixty subjects were used in all, thirty of whom were men, and thirty women. The men were, with two exceptions, soldiers referred to the hospital for psychotherapeutical treatment; the women, with four exceptions, members of auxiliary service organizations (the A.T.S. and the W.A.A.F.) referred for the same purpose. The six exceptions were civilians referred to the hospital because of nervous disorders consequent upon bombing.

Fifteen of the men, and fifteen of the women, were diagnosed as "conversion hysterics"; in no case could there be the slightest doubt as to the presence of a severe hysteria. A number of cases of "hysterical personality" and of "anxiety hysterias" were tested, but because of the possibility of disagreement regarding the diagnosis they were not included in the experimental group. Diagnoses were made by the doctor in charge of the patient. All subjects were interviewed by the writer and their case-notes carefully scrutinized.

Fifteen men, and fifteen women, were diagnosed as being free from any major hysterical symptom. This group of subjects consisted in the main of depressives and effort syndrome cases, and included a number of patients who were not genuinely neurotic at all. Dr. A. Lewis interviewed a number of these patients who had proved particularly suggestible, and confirmed that they were not hysterical in the least.

The average ages of the resulting four groups of fifteen patients each were: Male hysterical, 27·1; female hysterical, 26·5; male non-hysterical, 26·2; female non-hysterical, 24·4. The scores of the four groups in the "Matrices" Intelligence Test are given below; it will be seen that the differences between the groups are very small.

The tests.—The tests used were all of a standard kind and a good deal of data had been accumulated with regard to the performance of children, normal adults, groups of high and low intelligence, etc., so that the results obtained in this study could be seen against a factual background.

1. *Progressive weights.*—This test, first described by Binet (1900), has been used extensively. Fifteen boxes, numbered 1 to 15, are put in front of the subject in a semicircle on the table. Boxes 5 to 15 all weigh 100 grams; box 1 weighs 20 grams, box 2 40 grams, box 3 60 grams, and box 4 80 grams. The subject is told that these boxes all differ in weight (in the standard test, as described by Binet, the subject is not told anything about the weights of the boxes; the present procedure was adopted for reasons which will become apparent later on); he is required to lift them one at a time, starting with number 1, and say whether box 2 is heavier or lighter than number 1, box 3 than box 2, and so on. His responses are taken down in full, and after each judgment he is encouraged by the experimenter who nods approvingly and says "Yes," or "Yes, quite right," regardless of the nature of the reply. In spite of the instructions 59 out of the 60 subjects gave a number of "same" judgments.

Whipple (1921) advised scoring this test by simply counting the number of heavier judgments after the weights of the boxes had become objectively equal; this continuance of a previously correct response in spite of altered circumstances was thought to measure suggestibility. Brown (1916) and Williams (1930) in their work followed Whipple's suggestion, but Hull and Forster (1932) pointed out that this method of scoring left much to be desired, and suggested a different method based on the normal curve of distribution. To the present writer, it appears that two entirely different phenomena must be distinguished in the scoring. First, there is the tendency to go on calling the boxes "heavier" although they are objectively equal. This can best be measured by subtracting the number of "lighter" calls from the number of "heavier" calls on the last ten boxes.

Secondly, there is the definite suggestion that the boxes will all differ in weight from one another. Response to this suggestion can best be measured by adding the number of "heavier" and "lighter" judgments on the last ten calls. It might be argued that in the usual Binet technique no suggestion is given to the effect that the weights are different, and that therefore this particular score would be meaningless. Our answer would be that the suggestion is implicit in the procedure adopted. A number of controls to whom the ordinary Binet instructions were given were questioned as to whether they expected the weights to be the same or different; they all expected them to be different rather than the same. Thus our instructions serve simply to make the situation more definite, and eliminate the variations of "set" which are inevitable when the usual instructions are given. These two ways of scoring this test will be called "impersonal" and "personal" respectively, because the first way of scoring would seem to involve the use of impersonal suggestion, while the second method would seem to involve personal suggestion.

A second form of this test was given in order to get some idea of its reliability. This time, the first five boxes decreased in weight, and the remainder of the boxes were equal in weight to the lightest of the first five. The actual weights were 100 grams, 60 grams, 40 grams, 30 grams, 20 grams, and a series of 10 20-gram boxes. The reliabilities, as calculated by correlating these two forms of the test, are very low. For the personal method of scoring, the reliability is 0·43; for the impersonal method, only 0·09.*

2. *Progressive lines.*—The progressive lines test is similar in every way to the progressive weights test, except that the objects being compared are lines. Fifteen white cards, 3 by 5 inches, were used for this test. On each card a line was drawn in ink, somewhat off centre, so that judgments of length were made more difficult. The length of these lines was ½, 1, 1½, 2 and 2½ inches for the remaining eleven cards.

These cards were exhibited by the experimenter at a constant rate of 1 every 5 seconds, at a distance of 4 feet from the subject's eyes. Instructions and comments were as in test (1), with the obvious modifications. A second form of the test was given in which the lines grew shorter at first; here the first line was 2½ inches, the second line 1½ inches, the next 1 inch, the next ¾ inch, and the remainder ½ inch. The reliability coefficients are rather

* It should be borne in mind throughout this paper that according to Fisher's (1932) method of calculating the significance of small samples, a correlation of 0·25 is significant ($p=0·05$), while a correlation of 0·32 is very significant ($p=0·01$), when $n=60$.

higher for these tests, being 0·57 for the personal method of scoring, and 0·24 for the impersonal method.

3. *Body sway.*—This test, first suggested by Hull (1929), has been described in detail by him, and we need only note that it consists essentially in a measured response to the suggestion of postural sway. The subject is asked to stand at ease, and to remain quite relaxed. He is then asked to close his eyes. While he stands thus, a thread is pinned on to his clothes. This thread is connected, by means of several hooks, to a weight and a pointer which run on a scale. Any movement of the subject is reflected in a movement of the pointer on the scale. The thread is attached to the clothing of the patient at a uniform height, thus making unnecessary the correction for height of the subject suggested by Hull.

While the subject stands quietly for 30 seconds the movement of the pointer is noted in order to obtain a record of the amount of sway in the absence of any suggestion. Then the experimenter begins to say slowly and deliberately; " Imagine you are falling forward. You are falling forward, forward. You are falling forward, forward. You are falling. You are falling forward . . ." If the subject has not fallen after 2½ minutes, the test is stopped and the maximum amount of sway noted.*

Scoring was in terms of maximal sway in inches; if the subject swayed 5 inches forward, his score was 5. When the subject fell forward altogether, so that he had to be caught in order to prevent him from falling, he was given an arbitrary score of 12 if the fall came after one minute, and a score of 15 if the fall came within the minute.

In order to get a reliability coefficient, the test was repeated in each case after a few minutes, the suggestion this time being " you are falling backwards." The reliability is very satisfactory, being 0·91.

4. *Arm levitation.*—Here the subject is seated on a chair and told to hold out his right arm sideways at the level of his shoulder. Then he is told to shut his eyes, and the same recording device as before is attached to his cuffs by means of the thread and needle. After his tremors and involuntary movements have been studied for 30 seconds, suggestions are made for 2½ minutes that his arm is feeling lighter, and is rising. Again the extent of the rise is measured on the scale.

A few minutes after the completion of this test, the same procedure is repeated with the exception that now the experimenter suggests that the arm is getting heavier, and is falling. The correlation between these two forms of the test is only 0·35. This very low value appears to be due to an important type-factor which seems to divide the suggestible subjects into two classes. Many of the older hypnotists maintained that there are two types of hypnotic subjects, called variously active and passive, or alert and lethargic (*cf.* the works of Binet, Moll, Bernheim, Trommer, *et al.* for early recognition of this distinction). Recently, Young (1925), White (1937), and Davis and Kantor (1935) have revived this old distinction, and added much interesting descriptive detail. Now it would appear that in suggestibility we have a very similar difference. The active, alert subjects who are suggestible raise or lower their arms quickly and in accordance with the suggestion; the passive, lethargic subjects lower their arms when told to, but they also lower their arms when told to raise them.

This type difference would seem to account for the low reliability. We may also suggest that here we have an excellent test by means of which we can distinguish objectively between these two types of suggestibility. Further work is needed to show whether these two types are identical with the hypnotic types described by the writer quoted, and whether the results of the suggestibility test can be used to predict the type of trance into which the subject will fall.

5. *Chevreul pendulum.*—This test seems to have originated with Chevreul (1854). In the form used in this investigation, it consists of a small weight suspended from a thread. The experimenter holds this weight over the centre of a ruler, and tells the subject that this is a test of steadiness. The subject will be required to hold the bob still while looking from one end of the ruler to the other. The experimenter demonstrates, and as he looks from one end of the ruler to the other, and back again, the pendulum is seen to start swinging. The experimenter continues till the pendulum swings the whole length of the ruler, explaining that movements of this kind tend to occur inevitably in everybody; then hands the thread and the bob suspended from it over to the subject. The subject then looks from one end of the ruler to the other, and the amount of suggestion transmitted is measured by the amount of swing imparted to the pendulum. Scoring was in terms of maximum swing; 0 points if the swing was less than 1 inch either way, 1 point if the swing was less than 2 inches, 2 points if it was less than 4 inches, and 3 points if it was above 4 inches. This test is reported to have a retest reliability of approximately 0·90 (Saltzman, 1936).

6. As explained above, certain tests were given in addition to the suggestibility tests. The first of these was an intelligence test which is used as a routine test at the Hospital: Raven's " Matrices " test. On the basis of the scores subjects are divided into five groups, from Grade 1, the very intelligent, to Grade 5, the very dull. Full details regarding this test are given by Raven (1939, 1941). The reliability of this test is approximately 0·90.

7. Two tests of perseveration were given. The first consisted in having the subject write a line of S S S S S for 15 seconds, followed by a line of ƨ ƨ ƨ ƨ ƨ. Then another line of S S S S S followed by another line of ƨ ƨ ƨ ƨ ƨ. Next, the subject is asked to write for 15 seconds alternate S and inverted S; this is repeated for three further periods of 15 seconds. His score is the total number of letters written in the first four periods, divided by the number written in the last four periods.

The second test is similar, triangles pointing upwards and pointing downwards being used instead of S and S reversed. The correlation between these two forms of the perseveration test is extremely low, viz. 0·11. Further information regarding the tests is given by Spearman (1932).

8. *Personal tempo.*—This concept has played a large part in German psychology (Frischeisen-Köhler, 1933; Guttman, 1931; Neumann, 1913; Braun, 1927), and also recently in American work (Reymert, 1923; Harrison, 1941). As a measure the total number of items written in the first 15-second periods of the perseveration tests was used. The reliability, as calculated from the correlation between the total number of triangles and S's written, is comparatively high, viz. 0·60.

Results

Table I gives the average scores in each of the tests used for the sixty subjects, and also the standard deviations. The methods of scoring, and the reliabilities of the tests, have been discussed in the previous section.

The distribution of scores is of interest, particularly as regards the various tests of suggestibility. (In the other tests the distribution approaches the normal probability curve more or less closely.) In Figs. 1 and 2 are given histograms of the distribution of scores for the Body Sway test, the two forms of the Progressive Lines and the Progressive Weights tests, the Pendulum test, and the Arm Levitation tests. (In the Body Sway test and the Progressive Lines and Weights tests the two forms whose averages are given separately in Table I have been combined for the purpose of drawing the histogram.)

* In a few cases, subjects were found to be negatively suggestible; thus two men fell over backwards when the suggestion was " Falling forward." Scoring was *irrespective of the direction of the fall.*

TABLE I

Progressive weights, personal (A)	6·4 ± 2·65	Arm levitation, up	−1·2 ± 5·96*
,, ,, ,, (B)	5·0 ± 2·84	,, ,, down	6·1 ± 5·49*
Progressive weights, impersonal (A)	2·7 ± 2·98	Perseveration, S	1·3 ± 0·43
,, ,, ,, (B)	0·0 ± 2·74	,, triangles	1·2 ± 0·34
Progressive lines, personal (A)	4·5 ± 2·59		
,, ,, ,, (B)	2·5 ± 2·11	Personal tempo, S	48 ± 11·3
Progressive lines, impersonal (A)	0·1 ± 2·70	,, ,, triangles	50 ± 13·3
,, ,, ,, (B)	0·4 ± 1·64	Matrices	2·7 ± 1·05
Body sway, forward	5·4 ± 5·22*		
,, ,, backward	4·9 ± 5·66*	Chevreul Pendulum	1·3 ± 1·2*

* The abnormal distribution of scores in these tests partly invalidates the use of the S.D.

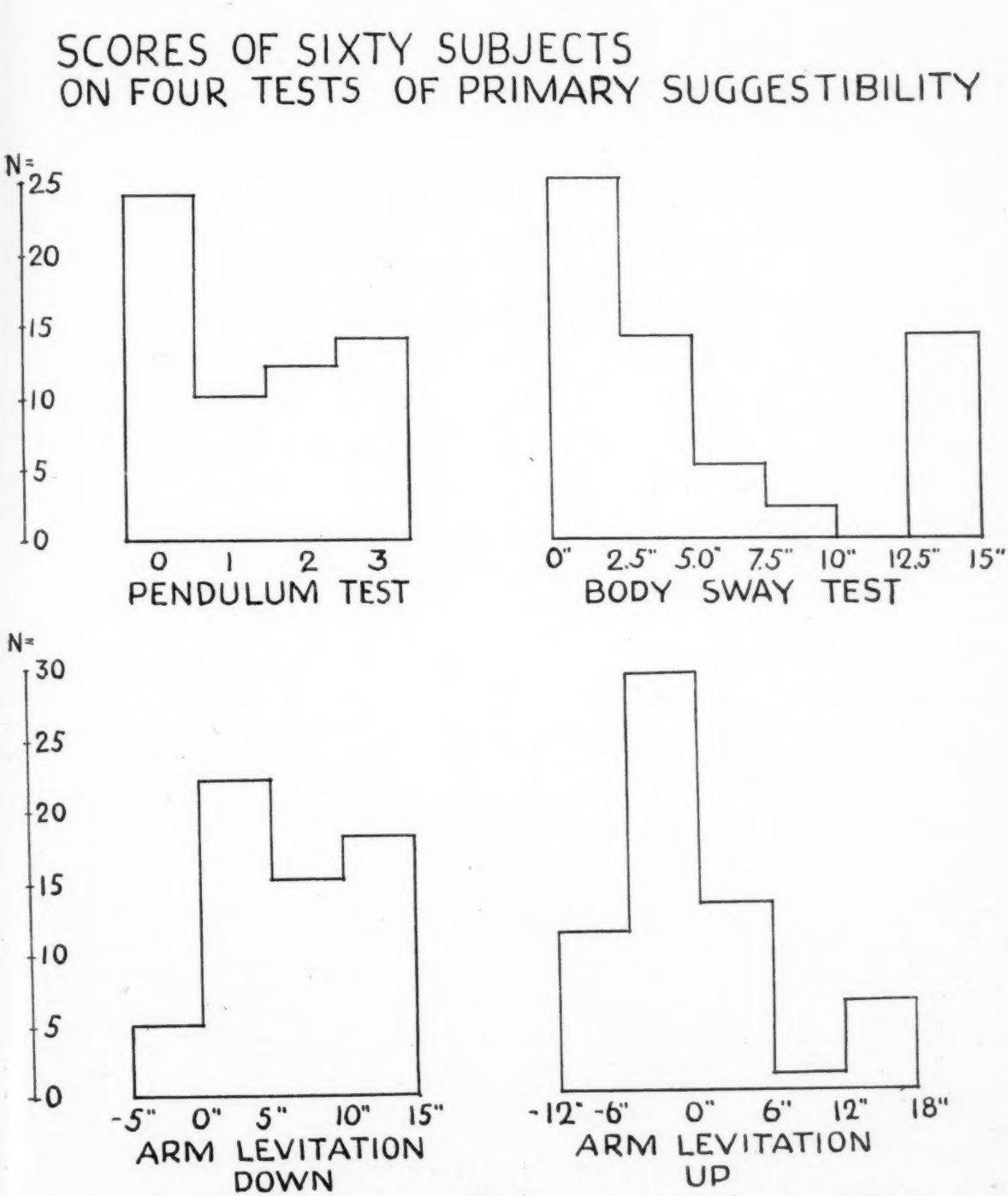


FIG. 1.

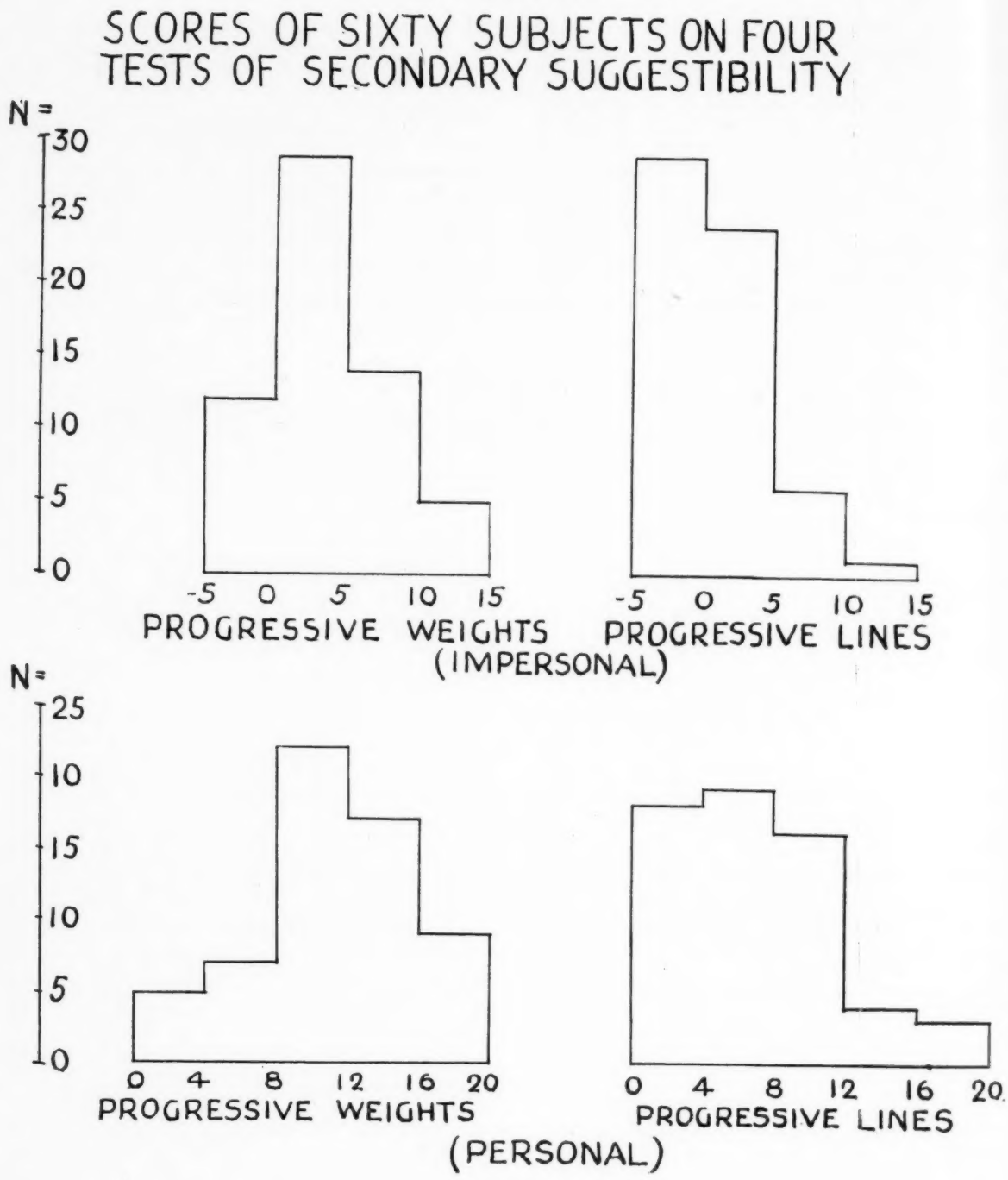


FIG. 2.

These curves confirm the suggestion made by Aveling and Hargreaves (1921), and later also confirmed by Estabrooks (1929), that "personal prestige suggestion" is characterized by a U-curved distribution while the "non-prestige suggestion" curve of distribution approaches the normal curve.* Life (*cf.* Hull, 1933) had found an L-shaped curve of distribution when giving the Body Sway test to 64 students; this result is probably an artifact due to the preselection of intelligence implicit in the use of university students. (The relation between intelligence and suggestibility will be discussed below.)

These curves also supply evidence on the important question of whether or not there is any negative non-prestige suggestion. Hull (1932, p. 336) considered the existence of such a phenomenon possible, but did not think that the evidence sufficed to come to any definite conclusion. It will be seen, from Fig. 2, that a fair number of our subjects are negatively suggestible when tested with the two tests used in this investigation. We may, then, consider the

* Exceptions to this rule are the progressive weights and the progressive lines test (personal forms). As we shall see later on the customary distinction between personal prestige and non-prestige tests does not accord with our experimental findings and remains to be replaced by a different distinction. For the purposes of convenience the old nomenclature is retained in this section as well as in the previous ones.

existence of negative non-prestige suggestibility as probable.

We are now in a position to compare directly our main groups of subjects with regard to their performances on these various tests. For this purpose we have combined the scores on the two forms of the Weights test (both for the Personal and Impersonal method of scoring), on the two forms of the Lines test (both methods of scoring), on the two forms of the Body Sway test, the Perseveration tests, and the Personal Tempo tests. The resulting scores, given separately for hysterics and non-hysterics, and for men and women, are shown below in Table II.

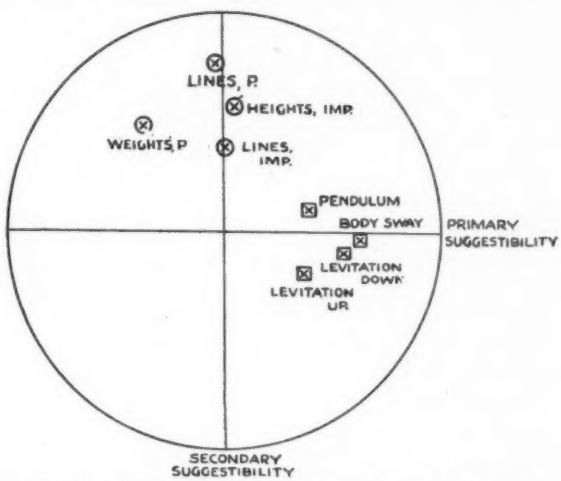
TABLE II

Test	Hysterics	Non-hysterics	Men	Women
1. Weights, personal	5·8	5·6	5·8	5·6
2. Lines, personal	3·4	3·6	3·7	3·3
3. Weights, impersonal	3·0	2·5	2·9	2·5
4. Lines, impersonal	−0·1	1·0	0·7	0·2
5. Pendulum	1·6	1·0	1·5	1·1
6. Body Sway	5·7	4·5	6·5	3·6
7. Arm levitation, up	−1·6	−0·8	−1·5	−0·9
8. Arm levitation, down	7·0	5·1	6·1	6·1
9. Perseveration	1·23	1·29	1·31	1·20
10. Personal tempo	47·3	49·1	48·5	47·5
11. Intelligence	2·9	2·5	2·5	2·9

It will be seen that for the prestige tests there are certain small differences between the groups; thus in the Pendulum and Body Sway tests the hysterics are slightly more suggestible than the non-hysterics, and the men than the women. However, when the large standard deviations of the scores are taken into account, the differences fade into insignificance; in no case is the Critical Ratio higher than 2! In other words, there is no evidence here to suggest that with respect to suggestibility there is any difference between hysterics and non-hysterics, or between men and women. The latter conclusion rather contradicts the findings of Hull (1933), working with 41 men and 28 women, and of Aveling (1921), working with 79 boys and 42 girls; who found females more suggestible. Their results, however, were of doubtful statistical significance.

Regarding the non-prestige tests, we also find no reason to assume that hysterics are more suggestible than non-hysterics; their scores are almost identical. Again we find, however, that the men are slightly more suggestible than the women, although the difference is definitely not statistically significant. This finding is in conflict with the results reported by Messerschmidt (1933), Brown (1916), Gilbert (1894), Seashore (1895), Dressler (1894), Yung (1908), Wolfe (1898), and Hurlock (1930), who found women slightly more suggestible, while it agrees with the results reported by Otis (1924). In all these studies, however, the differences found were slight, and of doubtful significance. This question will be taken up again later on.

Next we must turn to the interrelations between the various tests of suggestibility. These are given below, in Table III. A factorial analysis shows clearly that we have to do with two entirely unrelated factors (*cf.* Fig. 3). On the one hand, we have the Progressive Weights and Progressive Lines tests, scored both for personal and for impersonal suggestion; on the other hand we have the Pendulum, Body Sway, and the two Arm Levitation tests. An interpretation of these factors will be attempted in a later section.*



FACTORIAL PATTERN OF EIGHT TESTS OF SUGGESTIBILITY

FIG. 3.

Certain other correlations are of interest. Thus the question arises as to whether intelligence is correlated with prestige suggestibility, as Hull (1933, p. 86) believes. He assembles data from eight separate investigations, carried out by Aveling and Hargreaves (1921), Barry, Mackinnon and Murray (1931), White (1930), Davis and Husband (1931), and Hull and Life (unpublished), and finds

* This particular table of correlations raises certain problems with regard to the proper method of factorial analysis to be adopted, which cannot be discussed here. An adapted form of Thurstone's (1935) method of rotation was used, the angle of rotation being 45°.

TABLE III

	1	2	3	4	5	6	7	8	Factor I	Factor II
1. Weights, personal	—	0·610	0·230	0·121	−0·256	−0·090	−0·159	−0·216	**+0·509**	−0·371
2. Lines, personal		—	0·295	0·194	0·095	0·133	−0·103	−0·127	**+0·772**	−0·002
3. Weights, impersonal			—	0·308	0·144	−0·070	−0·186	0·187	**+0·558**	+0·048
4. Lines, impersonal				—	0·156	−0·090	0·032	−0·076	**+0·386**	+0·016
5. Pendulum					—	0·329	0·107	0·174	+0·094	**+0·386**
6. Body sway						—	0·257	0·410	−0·041	**+0·623**
7. Levitation, up							—	0·351	−0·194	**+0·370**
8. Levitation, down								—	−0·100	**+0·546**
									+0·172	+0·142

that among these data covering 296 subjects there are correlations ranging from +0·34 to 0·00; he accordingly concludes that " the . . . evidence . . . is in perfect accord with the experience of hypnotists that normally intelligent individuals make the best hypnotic subjects, and that feeble-minded individuals are apt to make poor subjects " (*ibid.*).

The Body Sway test correlates 0·159 with intelligence, and the Pendulum test 0·138. These correlations are not significant statistically, but as far as they go they seem to bear out Hull's point. Careful inspection of the data, however, suggests that the product-moment correlation is not really a formula which can justifiably be used in connection with these data, as this formula demands a linear relationship between the tests correlated. When the correlation ratio η is calculated for the Body Sway test it is found to have the comparatively high value of 0·52. Using this value, which is definitely significant statistically, as a test of the linearity of the original data, we find $\zeta = 0{\cdot}24$, which according to Blackman's test proves that the relationship is non-linear. The original data show quite clearly that in this case, as well as in the case of the pendulum and the arm levitation tests, there is a marked tendency for the highly intelligent and for the highly unintelligent to be less suggestible than the average. If, to give an illustration of this phenomenon, we divide the subjects who took part in the Body Sway test into those who were suggestible (arbitrarily defined as swaying more than 2·5 inches) and those who were not, we find that of those who had a 1 or 2 rating on the matrices test the same number were suggestible as not; similarly for those who had a 4 or 5 rating. For those, however, who had an average rating (Grade 3), almost four times as many were suggestible as not. Similar relations obtained in the other tests mentioned.

This curvilinear relationship between intelligence and prestige suggestibility may be responsible for the slight and non-significant differences between hysteric and non-hysteric patients, and between men and women, which are summarized in Table II. Twice as many men as women scored Grade 3 on the matrices test, and over three times as many hysterics as non-hysterics. If, then, as we have shown, there is a connection between medium intelligence and high suggestibility, we would expect men and hysterics to score slightly higher than women and non-hysterics, which is precisely what we found. This non-linear relationship may also explain some of the rather conflicting results obtained by earlier workers, summarized above.

As regards the non-prestige tests, there are few significant correlations with intelligence in our data; the Weights test and the Lines test, both " personal " form, correlate negatively with intelligence (−0·126 and −0·278 respectively). Scored " impersonally " the correlations are respectively −0·299 and +0·112. These almost uniformly negative correlations are well in line with the results reported by Simmons (1940), and seem to justify the use made of tests of this kind in the testing of intelligence by Binet. It should be noted that none of these tests shows a curvilinear relationship with intelligence when the scatter-diagrams are analysed.

There are certain further correlations which have at least a suggestive value. Both the Arm-Levitation tests are correlated negatively with perseveration (−0·165 and −0·261; the latter value is significant). The perseverator, it would appear, is more difficult to move in the desired direction than the non-perseverator. This analysis, however, is not borne out by the correlation of the Perseveration test with the Body Sway test, which is almost zero (+0·039), or with the Pendulum test, which is +0·120.

Personal Tempo correlates negatively with the Pendulum test (−0·182), the Body Sway test (−0·234), and the Arm Levitation test, where the arm is raised (−0·215); the correlation with the " arm down " Levitation test is positive, however (+115). Correlations with the impersonal Weights and Lines tests are also negative (−0·262 and −0·114). It would appear that the person who is quick is less susceptible to both kinds of suggestion.

Personal Tempo is not related to perseveration, the correlation being quite insignificant (−0·056). The correlation of Personal Tempo with intelligence is almost significant (−0·232), but difficult to interpret. Perseveration is not significantly related to intelligence (0·108).

Apart from the information contained in the various scores and correlations given above, a good deal of information was obtained which does not admit of quantification, but which may be of importance in determining the nature of suggestibility. This information is derived from interviews, study of the case papers, and observation of the patients while they were being tested. It became obvious very soon that in the Personal Prestige tests, i.e. the Body sway test, the two Arm Levitation tests, and to a smaller extent in the Pendulum test also, we were dealing with two separate factors, viz. aptitude and attitude. These factors appeared most obviously in the Body Sway test, and we shall therefore attempt to elucidate our meaning by describing certain typical reactions to that test.

As regards aptitude, there was quite clearly a definite graduation in the amount of emotional response to the whole situation, ranging from complete indifference to almost somnabulistic trance. As regards attitude, there was a similar graduation from very favourable through neutral to very unfavourable. (One woman opened her eyes after suggestion had begun and said: " Oh, doctor, I do so much want to be suggestible ! " She proved extremely unsuggestible. A man shook his head all the time that suggestion was proceeding, and said " no ! " quite audibly whenever it was suggested to him that he was falling. He proved very suggestible nevertheless.)

We are justified in making the differentiation between aptitude and attitude for the following reason. It is easy to see whether the patient is helpful, tries to co-operate, and generally has a favourable attitude towards the experimental situa-

tion, and the experimenter, or whether he is difficult, indifferent, or actively hostile towards situation and experimenter, and generally tries to counteract every suggestion. If this attitude determined the outcome of the experiment, clearly we would not have to go any further in order to look for an explanation of the phenomena encountered. But the correlation between attitude and suggestibility is far from perfect; two instances of an inverse relationship are quoted above.

Consequently we have to assume another factor, which we have called aptitude. When this aptitude is absent, even the most favourable attitude will not make the patient concerned suggestible; compare the case of the woman described in the penultimate paragraph. When the aptitude is present, however, certain reactions are bound to appear. If aptitude is joined to positive attitude, we find the ideal suggestible subject, who reacts almost at once to everything that is suggested to him. If aptitude is joined to negative attitude, however, very interesting manifestations become apparent. The patient clenches his fists, begins to tremble violently as he fights against the power of the suggestion; the women often break out in tears and may be unable to finish the experiment. These emotional reverberations are very powerful; they seem consequent in every case upon the conflict between aptitude and negative attitude. Sometimes, as in the case mentioned above, the patient proves very suggestible in spite of his negative attitude; his conscious opposition is powerless against the force of the suggestion.

It might be thought that perhaps here we have the reason why our results did not show any difference between hysterics and non-hysterics; the hysterics, it might be said, have greater aptitude but perhaps a more negative attitude. This suggestion, however, is not borne out by the facts; both aptitude and attitude seem to be evenly distributed among hysterics and non-hysterics. (The judgment of attitude is based on direct observation, questioning of the patients, and perusal of the case notes.)

The introspections of the patients are very revealing. After each test the patients were encouraged to talk freely about the way they reacted, how they "felt about it," what it "felt like," and so on. Those who showed themselves suggestible felt as if they were being pulled forward by somebody, or as if their arms (in the Levitation test) were being pushed down or up, as the case might be. One patient said the words of the suggestion gave him "electric shocks." They were often unconscious of the extent of their reaction; some did not know, for instance, that their arm had moved through an angle of almost 90°, and looked for it at the place where it had been when the levitation experiment started!

One reaction is of interest, as it may give some comfort to adherents of the Freudian school (e.g. S. Ferenczi). One girl, when asked what it had felt like, doing the Body Sway test, answered: "Like falling in love!" She was rather a stupid girl, and the superficially plausible explanation that she was trying to flirt does not seem very probable.

Discussion

The results reported in Table III show very clearly that there are two quite independent types of suggestibility. Due largely to the work of Aveling and Hargreaves (1921) and of Hull (1933), such a distribution has been recognized for a long time, and has usually been related to the presence or absence of personal or prestige suggestion. Our results do not bear out this theory. The Progressive Lines and Weight tests, personal form, correlate significantly with the Progressive Lines and Weights, impersonal form, although in the personal form we are dealing with prestige suggestion; they do not correlate with the other personal prestige tests, i.e. Body Sway, Arm Levitation, and Pendulum.

Consequently it will be necessary to renounce the view that the difference between the two groups of tests is due to the presence or absence of personal prestige suggestion. In order to avoid implying a theory by the names given to the two types of suggestibility, we shall call the suggestibility measured by the Body Sway test, the Arm Levitation tests, and the Pendulum test primary suggestibility, and the suggestibility measured by the Progressive Weights and the Progressive Lines tests, both in their personal and impersonal forms, secondary suggestibility.

We may perhaps set out briefly the four main reasons for regarding these two types of suggestibility as entirely independent and separate. In the first instance, as we have seen, there is no correlation between tests of primary and of secondary suggestibility. Secondly, as Aveling and Hargreaves (1921) and Estabrooks (1929) have shown, and as we have been able to confirm, primary suggestibility is distributed in the form of a U-curve, while secondary suggestibility follows the more normal probability curve. Thirdly, as we have shown, primary suggestibility is related in a curvilinear manner to intelligence, while secondary suggestibility is related to intelligence in a linear manner. And lastly, as Hull (1932) has shown, practice increases primary suggestibility and decreases secondary suggestibility.*

There is strong evidence that primary suggestibility is related to hypnotizability (Beck, 1936; Saltzman, 1936; Dorcus, 1937; Jenness and Wible, 1937; Krueger, 1931; White, 1937; see, however, Williams, 1930; Wells, 1931), and consequently to dissociation (White and Shevach, 1942). We might, therefore, speak about dissociative suggestibility as opposed to non-dissociative suggestibility. However, there are certain difficulties in this theory. Dissociation is usually regarded as a neurotic symptom; it has been shown, however, that neurotics and normals do not differ significantly with respect to primary suggestibility (Bartlett, 1936; Messer, Hinckley and Mosier, 1938). Will dissociation go the same way

* A further point might possibly be that tests of primary suggestibility show high reliability, while tests of secondary suggestibility show low reliability.

suggestibility, which was first regarded as purely neurotic (Charcot, Janet), then as normal, but hypertrophied in neurosis (Bernheim *et al.*), and finally appear to be entirely normal and quite unrelated to neurosis? This question cannot be answered here, for experimental evidence is lacking. Until such evidence is provided, we may well retain such a neutral term as " primary suggestibility."

Secondary suggestion does not seem to involve any dissociation at all. The reason for this difference may easily lie in a factor stressed by the writer in connection with the improvement of mental and physical functions in the hypnotic state (Eysenck, 1939). It was shown there that the easiest, least complex performances, such as tapping, improved most under hypnosis, while the more complex performances improved little or not at all. The reason seemed to be that simple tasks involve only a small part of the cerebrum, which becomes easily dissociated, while complex tasks require the collaboration of large parts and tracts of the brain, thus making dissociation particularly difficult. Similarly here, primary suggestibility seems to be concerned mainly with simple, straightforward tasks, requiring essentially the construction of one ideo-motor pathway, while secondary suggestion requires complex processes of judgment, thus involving the whole cortex. Under these conditions, dissociation is impossible.

When the scores of our patients on the various tests are compared with scores made by non-neurotic subjects on similar tests as reported in the literature, it is found that there is very little difference. This result is in good agreement with the findings of Bartlett (1936), who found no difference between neurotics and normals in the Body Sway test. The reason for the general over-estimation of the suggestibility of neurotics in general, and hysterics in particular, seems to lie in the fact that judgments have up to now been based mainly on clinical impressions, i.e. almost exclusively on abnormal cases. Finding these abnormal cases very suggestible, and lacking a normal control group with which to compare them, quite naturally psychiatrists came to the conclusion that neurotics were particularly suggestible. A study of a normal group would soon have shown that suggestible people are found just as frequently among normal groups as among neurotics. The point is amusingly illustrated in a recent paper by Vega (1941), who found pregnant women particularly suggestible ; quite clearly no such conclusion is warranted in the absence of a control group.

It is important to emphasize this point ; our study found hysterics and non-hysterics equal in suggestibility not because the hysterics were non-suggestible ; they were very suggestible, but so were the non-hysterics. This eliminates one possible objection to our conclusion. Mapother and Lewis (1938, p. 1871) point out that " the much-stressed suggestibility of hysterics is a notable aspect of their especial responsiveness to a person with whom they develop an emotional relationship, often unrecognized by themselves as such." It might be said that the experimental situation failed to produce the necessary " emotional relationship." Such a criticism, however, would seem to be unfounded in view of the fact that in the particular situation of the experiment hysterics *did* prove to be very suggestible. It was only the surprising suggestibility of the non-hysteric group which forced us to deny the greater suggestibility of hysterics.

Summary

The evidence presented in this paper, based on the scores made by 15 hysteric men, 15 hysteric women, 15 non-hysteric men, and 15 non-hysteric women on eight tests of suggestibility, a test of intelligence, two tests of personal tempo, and two tests of perseveration, on the intercorrelations of these tests, on clinical histories of the 60 cases, on personal interviews, and on the introspections of the patients, seems to lead to the following conclusions :

1. In none of the tests of suggestibility used was there any significant difference between the hysterical and the non-hysterical group.

2. In none of the tests of suggestibility used was there any significant difference between men and women.

3. There was no significant difference between hysterics and non-hysterics in the tests of perseveration.

4. There was no significant difference between hysterics and non-hysterics in the tests of personal tempo.

5. The tests of suggestibility used fell into two sharply differentiated groups, called " primary suggestibility " and " secondary suggestibility " respectively.

6. Primary suggestibility is distributed in the experimental population in the shape of a U-curve.

7. Secondary suggestibility is distributed in the experimental population in the shape of a normal curve.

8. Primary suggestibility is correlated significantly with intelligence, the correlation being significantly non-linear. (Subjects of average intelligence proved to be the most suggestible group ; neither the highly intelligent nor the dull were particularly suggestible.)

9. Secondary suggestibility is correlated significantly with intelligence, the correlation being linear. The more intelligent the subject the less suggestible will he be on the average.

10. Evidence was found for the existence of negative primary and of negative secondary suggestibility.

11. Two factors were found to be active in primary suggestibility, viz. aptitude and attitude.

12. Primary suggestibility was shown to involve an important type factor, dividing those who were suggestible into an active, alert group, and a passive, lethargic group. This differentiation was found to be well in line with a similar distinction often made in the field of hypnosis.

13. Tests of primary suggestibility show high reliability.

14. Tests of secondary suggestibility show low reliability.

15. The results suggest that personal tempo is related negatively to both primary and secondary suggestibility.

16. Perseveration does not show any clearly defined relation to either primary or secondary suggestibility.

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References

Allport, G. W. (1937). *Personality*, Constable, London.
Aveling, F., and Hargreaves, H. L. (1921–22). *Brit. J. Psychol.*, **12**, 53.
Babinski, J. F., and Froment, J., (1918). *Hysteria or Pithiatism*, Univ. London Press.
Barry, H., MacKinnon, D. W., and Murray, H. A. (1931). *Human Biology*, **3**, 1.
Bartlett, M. R. (1935). *Arch. Psychol.*, No. 182.
—— (1936). *J. gen. Psychol.*, **15**, 191.
Beck, L. F. (1936). *Psychol. Bull.*, **33**, 747.
Bernheim, H. (1887). *De la Suggestion, et de ses applications à la thérapeutique*, Paris.
Binet, A. (1900). *La Suggestibilité*, Schleicher, Paris.
Braun, F. (1927). *Arch. ges. Psychol.*, **60**, 317.
Brown, W. (1916). *Univ. Calif. Publ. Psychol.*, **2**, 291.
Cameron, H. C. (1929). *The Nervous Child*, 4th Edition, Oxford Univ. Press.
Cattell, R. B. (1936). *A Guide to Mental Testing*, London Univ. Press.
Chevreul, M-E. (1854). *De la Baguette Divinatoire, etc.*, Mallet-Bachelier, Paris.
Davis, L. W., and Husband, R. W. (1931). *J. abnorm. (soc.) Psychol.*, **26**, 175.
Davis, R. C., and Kantor, J. R. (1935). *J. gen. Psychol.*, **13**, 62.
Dorcus, R. M. (1937). *Amer. J. Psychol.*, **49**, 82.
Dressler, F. B. (1894). *Ibid.*, **6**, 313.
Estabrooks, G. H. (1929). *Ped. Sem. and J. Genet. Psychol.*, **36**, 120.
Ewen, J. H. (1934). *A Handbook of Psychiatry*, Wood, Baltimore.
Eysenck, H. J. (1939). *Brit. J. med. Psychol.*, **18**, 304.
Fisher, R. A. (1932). *Statistical Methods for Research Workers*, 4th Edition, Oliver and Boyd, London.
Fisher, V. E. (1937). *An Introduction to Abnormal Psychology*, MacMillan, New York.
Frischeisen-Köhler, I. (1933). *Das persönliche Tempo*, Thieme, Berlin.
Gilbert, J. A. (1894). *Stud. Yale psycholog. Lab.*, **2**, 40.
Guttmann, A. (1931). *Z. angew. Psychol.*, **40**, 65.
Harrison, R. (1941). *J. gen. Psychol.*, **24**, 343.
Hirschlaff, L. (1919). *Hypnotismus und Suggestivtherapie*. Barth, Leipzig.
Hull, C. L. (1929). *J. abnorm. (soc.) Psychol.*, **24**, 153.
Hull (1933). *Hypnosis and Suggestibility*, Appleton-Century, New York.
——, and Forster, M.C. (1932). *J. exp. Psychol.*, **15**, 700.
Hurlock, E. B. (1930). *Ped. Sem. and J. Genet. Psychol.*, **37**, 59.
Jacoby, G. W. (1912). *Suggestion and Psychotherapy*, Scribner, New York.
Janet, P. (1907). *Major Symptoms of Hysteria*, Macmillan, New York.
—— (1924). *Principles of Psychotherapy*, Alien and Unwin, London.
Jenness, A., and Wible, C. L. (1937). *J. gen. Psychol.*, **16**, 197.
Krueger, R. G. (1931). *J. abnorm. (soc.) Pscyhol.*, **26**, 131.
Mapother, E., and Lewis, A. (1938). *Psychological Medicine*, in : Price, *Textbook of the Practice of Medicine*, Oxford Univ. Press.
McDougall, W. (1911). Article on "*Suggestion*" in *Encyclop. Britt.*
Messer, A. L., Hinckley, E. D., and Mosier, C. I. (1938). *J. gen. Psychol.*, **19**, 391.
Messerschmidt, R. (1933). *Ped. Sem. and J. Genet. Psychol.*, **43**, 405.
Morgan, J. B. (1936). *The Psychology of Abnormal People*, Longmans, New York.
Neumann, E. (1913). *Vorlesungen zur Einführung in die Experimentelle Pädagogik.*, Engelmann, Berlin.
Noyes, A. P. (1939). *Modern Clinical Psychiatry*, 2nd Edition, Saunders.
Otis, M. (1924). *Arch. Psychol.*, Nos. 64–70, 5.
Raven, J. C. (1939). *Brit. J. med. Psychol.*, **18**, 16.
—— (1941). *Ibid.*, **19**, 137.
Reymert, M. L. (1923). *Scand. sci. Rev.*, **2**, 177.
Rosanoff, A. (1920). *Manual of Psychiatry*, Wiley, London.
Saltzman, B. (1936). *Univ. Oregon psychol. Bull.*, **33**, 622.
Satow, L. (1923). *Hypnotism and Suggestion*, London.
Seashore, C. E. (1895). *Stud. Yale psycholog. Lab.*, **3**, 1.
Shaffer, L. F. (1936). *The Psychology of Adjustment*, Houghton Mifflin, New York.
Simmons, R. M. (1940). *A Study of a Group of Children of Exceptionally High Intelligence Quotient in Situations Partaking of the Nature of Suggestion*, Teachers Coll. Col. Univ. Contrib. Educ., No. 788.
Spearman, C. E. (1932). *The Abilities of Man*, Macmillan, London.
Stephenson, W. (1934). *Brit. J. med. Psychol.*, **14**, 105.
Thurstone, L. L. (1935). *The Vectors of Mind*, Chicago Univ. Press.
Travis, L. E. (1924). *J. abnorm. (soc.) Psychol.*, **19**, 283.
Travis, R. C. (1926). *Psychol. Monogr.*, **30**, No. 168, 18.
Tuckey, C. L. (1921). *Treatment by Hypnosis and Suggestion*, Baillère, Tindall and Co., London.
Vega, A. M. (1941). *Bol. Col. méd. Camaguey*, **4**, 142.
Wells, W. R. (1931). *J. abnorm.(soc.) Psychol.*, **25**, 436.
Whipple, G. M. (1921). *Manual of Mental and Physical Tests*, Warwick and York, Baltimore.
White, M. M. (1930). *J. abnorm. (soc.) Psychol.*, **25**, 293.
White, R. W. (1937), *J. Psychol.*, **3**. 265.
White, R. W., and Shevach, B. J. (1942). *J. abnorm. (soc.)Psychol.*, **37**, 309.
Williams, G. (1930). *Arch. Psychol.*, N.Y., No. 122.
Wolfe, H. K. (1898). *Psychol. Rev.*, **5**, 25.
Young, P. C. (1925). *Amer. J. Psychol.*, **36**, 214.
Yung, E. (1908). *Arch. Psychol., Genève*, **8**, 263.

A CASE OF ATYPICAL LINDAU'S DISEASE

BY

W. RUSSELL BRAIN, J. G. GREENFIELD, and D. W. C. NORTHFIELD

The case to be described is unusual in presenting most of the changes of Lindau's disease without any cerebellar tumour. In addition there is evidence of a hereditary tendency to the disease, as four relations of the patient suffered from progressive visual defect, and one other had an intracranial tumour.

The patient herself had an hæmangioblastoma in one retina and two in the other, an hæmangioblastoma of the spinal cord with extensive syringomyelia and cystic pancreas and kidneys.

History of illness

The patient, a female aged 39 years, was referred by Dr. W. A. Steel, Medical Superintendent of Hillingdon Hospital, and was admitted to the London Hospital on the 25th August, 1939, and later transferred to Chase Farm E.M.S. Hospital. Fifteen years previously she began to lose the sight of the right eye. Two years later, Mr. Frank Juler examined the patient and found the following condition : " In each eye the superior temporal branches of the central artery and vein show enormous dilatation, and appear to terminate in rounded prominent whitish masses, of which one is visible in the upper temporal periphery of the right eye, one in the upper periphery of the left eye and another a short distance external to the macula in the left eye. At the macula of the right eye there is a large deposit of yellow-white substance with a fairly sharp outline and a prominent circular black patch in its centre, probably an organized hæmorrhage. In the temporal periphery of the left eye there is some retinal detachment, and pre-retinal striae. R.V. = 6/60. L.V. = 6/5." Drawings of the fundi were made by Messrs. Theodore Hamblin Limited at that time, and are reproduced (Figs. 1*a* and *b*). Mr. Juler examined the patient again in February, 1929, and found : " The condition has progressed and the right eye has become cataractous, with detachment. Left eye—vitreous opacity is present. The superior temporal vascular dilatation is not so marked as in 1926, but the inferior temporal vessels are larger. There is more fibrosis over the fundus which obscures detail. The mass near the macula is visible but less obvious. There is also an indefinite mass in the upper periphery, evidently the remains of the swelling seen in 1926. There is peripheral detachment of the upper and lower temporal retina. The visual field shows a marked infero-nasal loss. L.V. = 6/18 partly." Dr. Wilfred Harris found no abnormality of the nervous system, and an X-ray examination of the skull was normal. Subsequently, in 1929, the right eye was removed on account of pain said to be due to retinal angioma. The sight of the left eye continued to deteriorate until she could only perceive light.

Three years ago a feeling of weakness developed in the toes of the left foot, there was intermittent stiffness of the left leg, and the foot would " jump off the ground." There was a feeling as though the shoe were too tight. One year ago the left leg became weak and clumsy and there was pain in the thigh on sitting. Nine months ago a " tight " feeling developed in the toes of the right foot, but the right leg has been weak for only three or four months. She could walk only with help. She had occasional discomfort at the left subcostal margin ; an occasional crushed feeling in the ulnar fingers of the left hand, and for a few weeks pain in the left side of the neck, the left shoulder and left arm. There was no girdle sensation and no sphincter disturbance. A number of her relatives had had illnesses which were highly suggestive of angioma (Fig. 2).

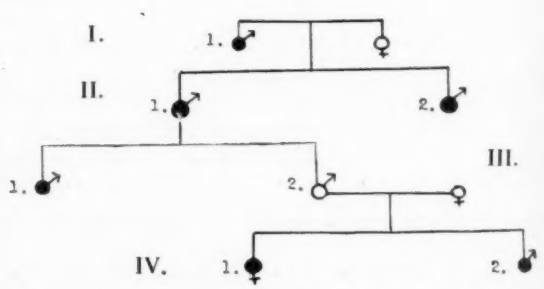

FIG. 2.

I. 1. Blind.
II. 1. Blind.
II. 2. Became blind and lost sense of taste.
III. 1. Had an intracranial tumour.
III. 2. Had no nervous symptoms and died of enteritis.
IV. 1. The patient.
IV. 2. Stated to have " retinitis."

Examination (17th October, 1939). No cutaneous tumours or pigmentation were found and the pulmonary, cardiovascular and alimentary systems were normal. Blood pressure 130/80 mm. Hg. Mentality, speech and articulation were normal. Right eye removed. Left fundus was invisible owing to cataract. Movements of the left eye were full, but there was nystagmus on fixation in all directions. The cranial nerves were otherwise normal. The upper limbs were normal. The lower limbs showed moderate muscular wasting and

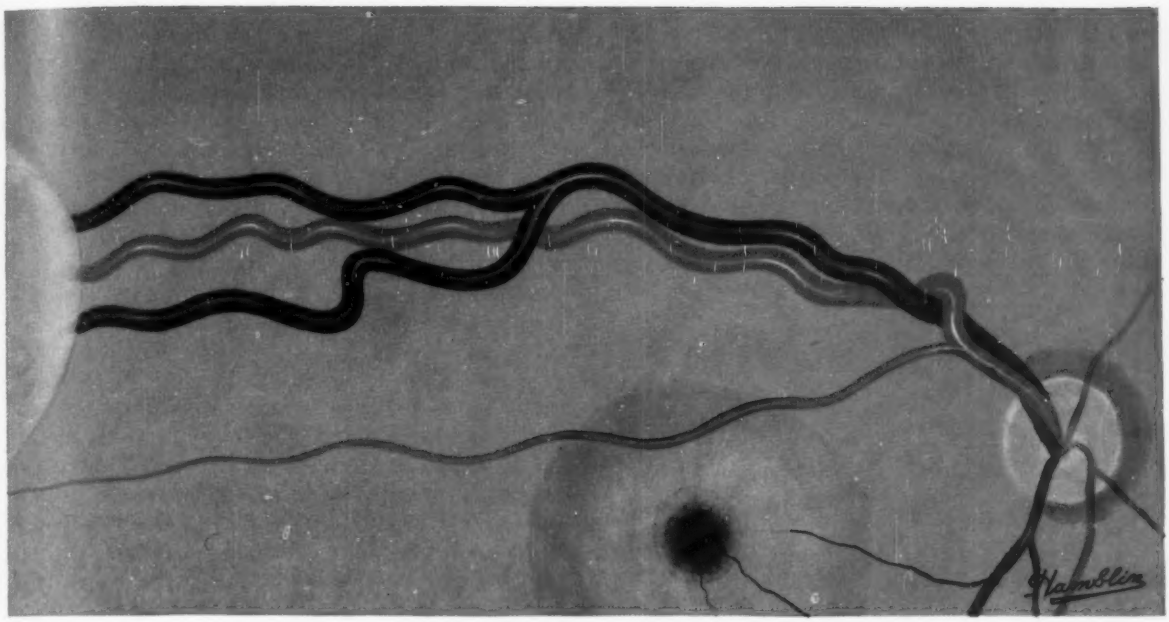

Fig. 1*a*.—Fundus of right eye.

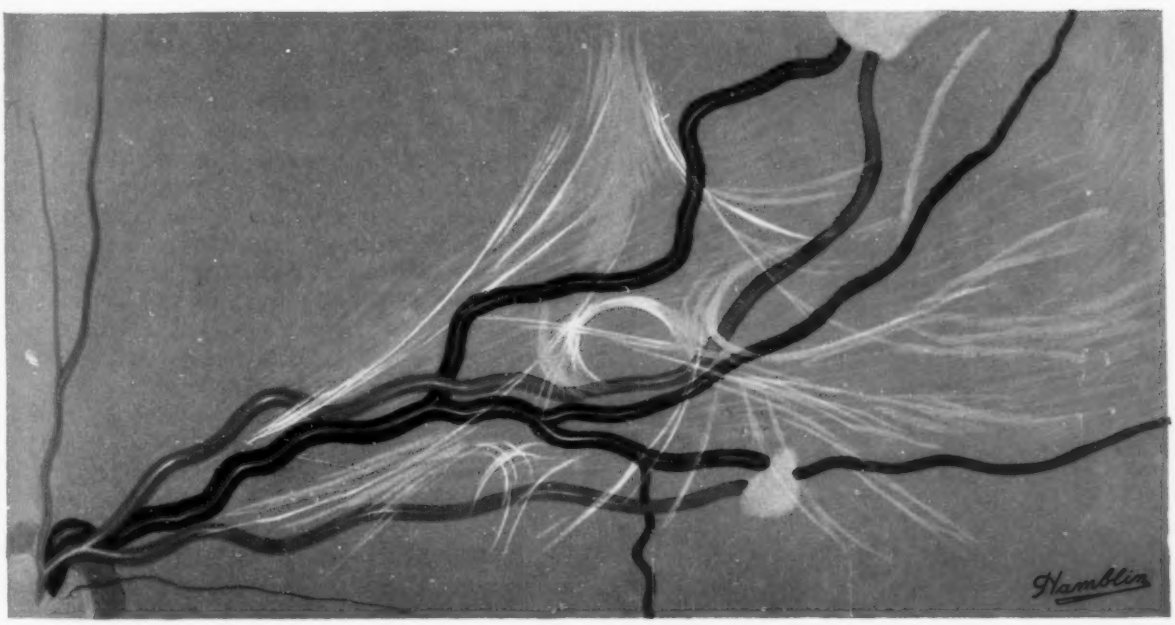

Fig. 1*b*.—Fundus of left eye.

spastic weakness greater on the left side. Bilateral ankle clonus and extensor plantar responses were obtained. The abdominal reflexes were absent. Relative cutaneous anæsthesia and analgesia were found below the eighth thoracic segments on both sides with sacral sparing, but the upper limit of this impaired sensation was ill-defined. Slightly impaired thermal recognition was found over the front of each lower limb. There was considerable impairment of postural sense in the toes, and of vibration sense at the ankles ; scoliosis was present, to the right in the thoracic and to the left in the lumbar region. Lumbar cerebrospinal fluid, resting pressure 120 mm. rising slowly and jerkily to 200 mm. on jugular compression and rising more quickly to 280 mm. on abdominal compression, falling quickly to 180 mm. and then slowly and jerkily to 140 mm. : pale yellow, slightly turbid fluid, containing 11 lymphocytes per c.m. and 1800 mgms. of protein per 100 ccs.

X-rays of the vertebral column revealed no abnormality ; after lumbar injection of lipiodol, Dr. Vilvandré reported : " Main bulk of the lipiodol remains low down in the spine, about the third and fourth lumbar vertebra, but the lipiodol is split up and appears as globules as far up as the eleventh thoracic vertebra, where it seems to remain for 20 minutes. On further tilting (head down), after another 20 minutes the upper level of the lipiodol globules is unaltered ; there seems to be stoppage at the eleventh thoracic vertebra, but throughout the lipiodol appears broken up ; there is no obvious evidence of complete narrowing of the canal, but general breaking up of the lipiodol." After cisternal injection, lipiodol rapidly descended the spinal theca without delay at any level.

A compression paraplegia was clearly present, but the level was indefinite, since the clinical and radiological findings did not coincide (thoracic sixth and thoracic eleventh vertebrae respectively). An angioblastoma seemed the most likely lesion, in view of the family and personal history, and of the high protein content of the cerebrospinal fluid with only a relative degree of subarachnoid block. One of us (D. W. C. N.) favoured a meningioma as the most likely extramedullary lesion to give such a slow progression and relatively severe incidence of posterior column loss.

On the 19th October, 1939, laminectomy of T 5–6 was undertaken but operation had to be abandoned after the bone had been removed on account of respiratory difficulties. Four days later further operation was undertaken, and as the exposed dura did not pulsate, further laminae in an upward direction were also removed. The spinal cord was very swollen and covered with a great number of adventitious vessels. No tumour was detected. An aspirating needle was inserted into the cord and 6 ccs. of clear faintly straw coloured fluid withdrawn. This was followed by shrinking of the cord and commencement of well marked pulsation. A small fragment of the wall of this intramedullary cavity was removed for biopsy and the wound closed. Histological examination showed this tissue to be the wall of a syringomyelic cavity.

Recovery from these operations was at first satisfactory. A week later, there was complaint of numbness, tingling and flushing of the face, and numbness of the hands so that she could not knit. Examination revealed no change in the state of the cranial nerves ; but in the upper limbs there was some increase of the tendon jerks of the right arm, ataxia, and slight impairment of postural sensibility of the little fingers. There was marked exaggeration of the signs of thoracic cord compression, for now there was virtually complete sensori-motor paraplegia below the tenth thoracic segment, and it was fully appreciated that a spinal tumour was present at a level lower than the laminectomy. Further operation was postponed owing to the

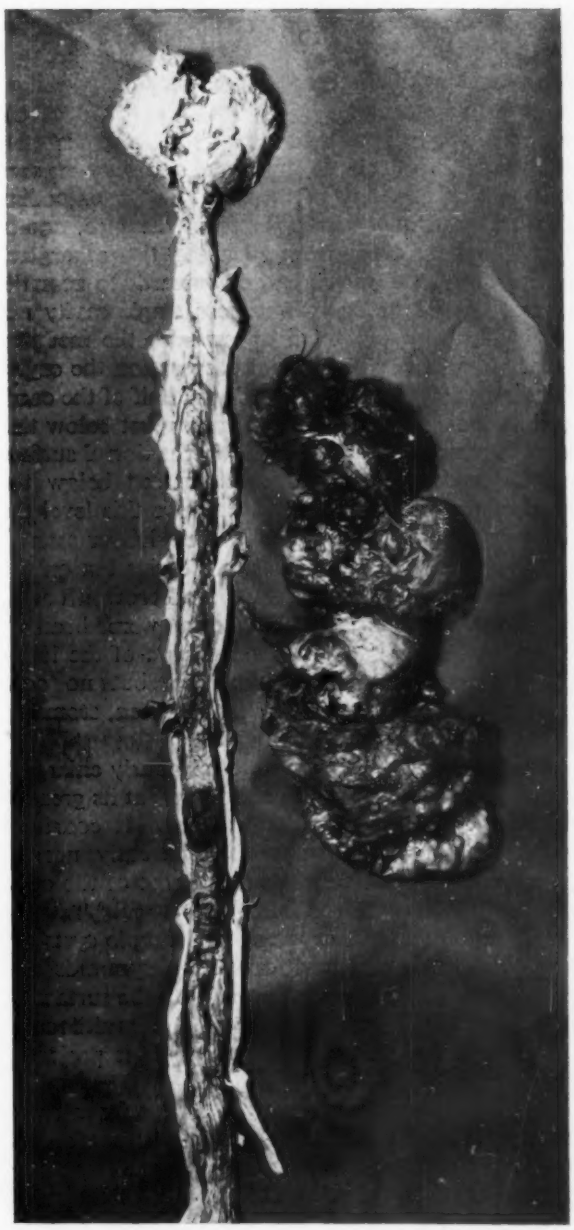

FIG. 3.—Spinal cord and pancreas.

patient's frailty. A few days later she developed signs indicating further spread of paralysis in the cord, i.e. greater ataxia, gross posterior column loss, palatal paralysis (motor and sensory), cough and cyanosis—and she died on the 6th November, 1939.

Post mortem examination.—This was made on the 6th November, 1939, less than twelve hours after death. The brain showed no abnormality except atrophy of the right optic nerve.

The spinal cord (Fig. 3) had been incised at operation at the lower end of the first thoracic segment. The whole cord was wider than normal, due to the presence in it of syringomyelic cavities. In the lower thoracic region there was an oval, orange-red tumour embedded in the dorsal surface of the cord at the level of the ninth and tenth thoracic segments, the lower part of the ninth and the whole of the tenth segment being involved. It measured $3 \times 1{\cdot}6$ c.m. The vessels on the dorsal surface below it were dilated and tortuous. The column of Goll was degenerated and grey above the tumour.

On section of the cord a syringomyelic condition was found extending up to the lower end of the medulla and into the conus terminalis. Immediately above and below the tumour three cavities were seen in transverse sections of the cord. After extending upwards and downwards for some distance, one of these cavities disappeared, leaving the other two cavities to run upwards and downwards to near the extremities of the cord, whence a single cavity ran down into the conus and upwards to the medulla. At the level of the pyramidal decussation the cavity filled a large part of the right dorsal half of the cord, and as the cord had been cut across just below this level in removing it from the body the dorsal surface of the medulla had become depressed below the level of the left side (Fig. 4). Above this level the cavity rapidly narrowed and was no longer seen at the lower end of the calamus scriptorius but on the left side here was a small discoloured brownish area.

The thyroid, heart, and aorta were healthy. There was some hypostatic congestion of the lungs especially in the right lower lobe, but no consolidation was present. The liver, spleen, stomach, and intestines were normal.

The *pancreas* (Fig. 3) was enormously enlarged, measuring 27 cm. in length and 10 cm. at its greatest width, which was towards the head. It consisted of very numerous cysts with apparently normal pancreatic tissue between them. Some of the cysts contained thin, dark red fluid.

In both *kidneys* there were small simple cysts the size of a pea at the junction of the pyramids and cortex and a few were also present on the surface of the organ. In the right kidney one multilocular cyst was found involving a papilla as it projected into the pelvis.

The suprarenals were normal except for a small accessory suprarenal the size of a split pea on the left side. The bladder contained a small quantity of milky purulent fluid. The surfaces of the rugae were inflamed, but the wall was otherwise healthy. The ovaries and uterus were normal. The right Fallopian tube was adherent to the mesentery in the region of the appendix.

The back of the left eyeball was removed from a few millimetres behind the ciliary body. The retina was seen to be thrown forwards except where it was attached to the disc by a rather broad pedicle, the front part of the retina being spread out flat behind the lens. The arrangement resembled an open umbrella of which the handle was represented by the pedicle. The retina was firmer than normal. Round the disc and overlying the choroid there was a whitish zone of fibrosis which was partly ossified. No angiomatous malformation could be seen on that part of the retina which remained attached to the choroid anterior to the plane of section.

Microscopical examination.—The posterior half of the left eye was sectioned in the antero-posterior plane. It was then seen that the pedicle already described was made up of thinned out retina, the two layers of which separated gradually from one another as they passed forwards and they then curved outwards to reach the lateral wall of the eyeball. Over the funnel-shaped cavity which thus presented forward, there was stretched a thin layer of collagenous connective tissue, lined on its posterior surface by a thin layer of endothelium. This became attached laterally to the anterior surface of the retina. It probably represented a greatly thickened anterior limiting membrane. The retina itself was everywhere very degenerated with disappearance of the outer granular layer and a great increase of neuroglial fibres, but the ganglion cells and the inner granular layer could be distinguished everywhere except in the region of the tumours.

Two definite small angioblastomas were found in the retina. One lay on the outer surface of the retina close to the disc. The two layers of retina were here joined together by thin strands of neuroglial tissue. This tumour was lentiform, measuring 0·4 mm. in thickness and 2·6 mm. in length. It consisted of a tangle of capillary vessels and contained also many larger thin-walled blood vessels about 30μ in diameter. Many of the endothelial cells forming the walls of the capillaries were swollen with rather granular cytoplasm. No neuroglial elements were seen within the tumour, although there was considerable overgrowth of neuroglial fibres round the tumour, and some fibres passed into its outermost zone.

The other tumour which was exactly similar in structure, lay just external to the point of junction between the thickened anterior limiting membrane and the retina. This was of the same thickness as the tumour nearer to the disc but did not extend in the plane of section for more than 1 mm. laterally. Some retinal pigment had migrated into this tumour. It was covered on its anterior surface by the thickened anterior limiting membrane, and several irregular whorls of dense collagen spread from this into the anterior layers of the tumour. Several fairly large cysts lay in the retina lateral to it.

A thin layer of bone lay over the choroid pos-

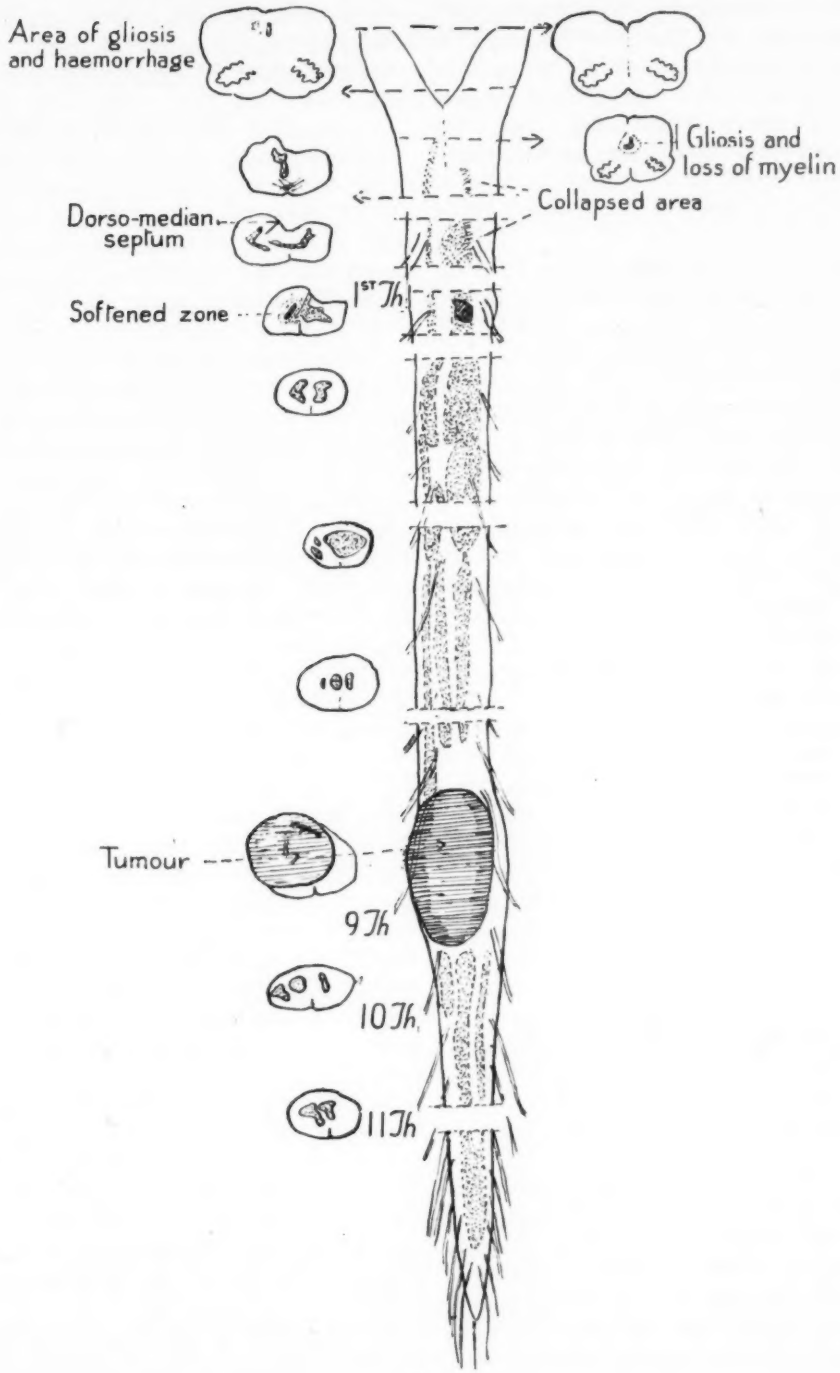

FIG. 4.

teriorly, forming a fairly wide zone round the disc. The optic nerve showed no evidence of degeneration.

The spinal tumour was a fairly typical hæmangioblastoma, the only abnormal feature being the presence of occasional very large irregularly shaped nuclei, some of which lay in large vacuolated cell bodies. The amount of collagen varied greatly in different parts of the tumour and was in inverse proportion to the degree of cellularity. There were fewer foamy cells than in many hæmangioblastomas of the central nervous system. With hæmatoxylin and eosin and with Masson's trichromic stain a few medium sized cells filled with oxyphil granules were seen in some areas. The syringomyelic cavities were lined by a fairly thick wall of astrocytes with thin fibres arranged for the most part concentrically to the cavity. The zone of gliosis varied little in thickness but was thinnest in the cervical region where it was about 250μ, and thickest in the lumbar region where it reached 400μ. At the level of the operation there was a narrow zone of softening anterior and lateral to the zone of gliosis surrounding the cavity which had been opened. This had been partially organized but still contained fat granule cells. Some rarefaction of the tissues in the same relation to this cavity could be traced a few

segments higher but none was seen at the level of the first cervical segment. The zone of softening at the first thoracic level passed through the position of the central canal, and it could not be identified here with certainty. At the other levels sectioned it lay ventral and internal to the cavities and was represented only by an irregular clump of ependymal cells. No ependymal lining was found in any of the cavities.

In the kidneys the cysts appeared to be lined by flattened epithelium, but this was rather broken in the sections. Round some there was an excess of small congested vessels which became gradually less numerous on passing outwards into the normal renal tissue. No hæmangiomas or vascular malformations apart from these could be seen in relation to any cyst. In one large cyst there was a collection of irregularly shaped cells with medium sized oval nuclei and irregularly cuboidal or elongated cell body. Some of these were packed side by side and resembled the desquammated epithelium of a collecting tubule. An occasional multinucleated cell was seen among them. Round this cyst there was a zone of connective tissue containing many foamy cells.

In the pancreas the cysts appeared to be formed by dilatation of ducts of all sizes. Many were surrounded by very thick connective tissue walls, containing large vascular channels. Apart from the cysts and dilated ducts there was a great excess of interstitial collagen in the pancreas which broke up the parenchymatous tissue into small groups of acini. No other abnormality was found in the pancreatic tissue.

Noteworthy clinical features

Until operation revealed the syringomyelia, no explanation was forthcoming for the pains on the left side of the neck and in the left upper limb, nor for the nystagmus. These symptoms were the only evidence of syringomyelia above the eighth thoracic segment, which was the upper level of the relative cutaneous sensory loss. The level of the first operation was determined by this clinical finding, as radiography with lipiodol gave little help. It is probable that the tumour was immediately below the site of this exploration, but no search was made in a downward direction owing to the absence of pulsation of the dura, due to the distension of the cord.

The rapid development of paralysis of the cervical cord and of the bulb after drainage of the cavity in the spinal cord may have been due to some vascular disturbance of the surrounding tissues. Following operative interference above the level of the tumour, there was also aggravation of the compression paraplegia. This type of reaction is not infrequent after lumbar puncture or after the cisternal injection of lipiodol, and is generally ascribed to displacement and wedging of the tumour, as a result of alterations in its water bed. This may have occurred in this instance, although the tumour was so securely anchored to the spinal cord as to render its displacement very unlikely. More probably, a vascular disturbance accounted for these symptoms as well as for those at the higher level

Pathological discussion

The case described is one of Lindau's disease in its most complete form, with one important exception ; the tumours and accompanying cyst formation in the central nervous system were in the spinal cord, and no tumour was found in the cerebellum. It is also unusual in the fact that two hæmangioblastomas were present in the retina of the left eye.

It must be remembered that Lindau was led to discover the syndrome to which his name has been given, by a study of cerebellar cysts, and therefore perhaps too much emphasis has been laid on the cerebellar incidence of the tumours. It seems probable that hæmangioblastomas of the spinal cord are less rare than was at one time thought, though comparatively few have been put on record. Kernohan, Woltman, and Adson found four hæmangioblastomas in the spinal cord, and three in the filum terminale and cauda equina among 67 primary tumours in these situations. These figures show an unusually high incidence of spinal hæmangioblastomas. In the cases examined at the National Hospital, Queen Square, during the period of twenty years from 1920 to 1939, only two hæmangioblastomas were found in relation to the spinal cord, both being extra-medullary. In this material there were 41 cases of glioma of the spinal cord, 7 of these being more or less symptomless tumours in cases of generalized neurofibromatosis. During the same period there were 32 cases of cerebellar hæmangioblastomas, among 164 primary tumours of the cerebellum and fourth ventricle, the great majority of which arose from nervous structures, i.e. gliomas, ependymal and choroid plexus tumours and neuroblastomas or ganglioneuromas. According to these figures hæmangioblastomas form a smaller proportion of primary tumours in the spinal cord and cauda equina than in the cerebellum and fourth ventricle. In the cerebral hemispheres their incidence is still lower and their relationship to primary tumours of the hemispheres very small indeed.

The literature of the last few years has brought to light a number of cases of multiple haemangioblastomas of the central nervous system, and in the great majority of these one or more tumours has been present in the spinal cord or its meninges. Our case differs from these only in the absence of any tumour in the cerebellum or fourth ventricle. Such cases have been reported by Schubach (1927), Kernohan, Woltman and Adson (1931), Wolf and Wilens (1934), Davison, Brock and Dyke (1936), Konig and Schœn (1939) and Craig, Wagener and Kernohan (1941). In 5 of these cases there was a hæmangioblastoma in the cerebellum and in the other, that of Konig and Schoen, as well as in that of Craig, Wagener and Kernohan, similar tumours in the fourth ventricle. In neither of these cases were retinal tumours found, but in three of the

others they were present in both eyes, and in the fourth on one side only. In all these six cases there was syringomyelia of greater or less extent in association with the spinal tumours. A cystic pancreas was present in all. The kidneys were described as cystic in all, except the case of Wolf and Wilens, and tumours described as adenomas, hypernephromas or carcinomas were present in all except the case of Konig and Schoen. A definite hereditary tendency was found in the cases of Konig and Schoen and of Craig, Wagener and Kernohan only.

Most of these authors comment on the relationship of the syringomyelia to the tumours. It appears in every case to have been a true syringomyelia in that it made only fortuitous connections with the central canal and over the greater part of its extent was separate from it. The consensus of opinion is that the syringomyelia resulted from a separate developmental abnormality and was not caused, as the cerebellar cysts appear to be, by transudation of plasma into the nervous tissue from the tumour. In our case the extension of the cavities up to the medulla, where they terminated in the grey matter round the central canal, that is in the same position as the cavities of idiopathic syringobulbia, points in the same direction.

We are greatly indebted to Mr. Frank Juler for his permission to use his clinical notes and the drawings of the fundi.

References.

Craig, W. M., Wagener, H. P., and Kernohan, J. W. (1941). *Arch. Neurol. Psychiat.* (*Chicago*), **46,** 36.

Davison, C., Brock, S., and Dyke, C. G., (1936). *Bull. neurol. Inst. N. Y.*, **5,** 72.

Kernohan, J. W., Woltman, H. W., and Adson A. W. (1931). *Arch. Neurol. Psychiat.* (*Chicago*), **25,** 679.

König, E., and Schoen, H. (1939), *Beitr. klin. Chir.*, **170,** 239.

Schuback, A. (1927), *Z. ges. Neurol. Psychiat.* (*Chicago*), **110,** 359.

Wolf, A., and Wilens, S. L. (1934), *Amer. J. Path.*, **10,** 545.

SPONTANEOUS VENTRICULAR RUPTURE IN HYDROCEPHALUS, WITH SUBTENTORIAL CYST FORMATION

BY

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(RECEIVED 9TH APRIL, 1943)

The anatomical features of hydrocephalus are fairly well known, and a growing knowledge of the pathology suggests that in most if not all cases the ventricular dilatation can be explained by obstruction to the circulation of the cerebro-spinal fluid. It is not always easy to identify the site or cause of the obstruction, but a common place is in the narrows of the midbrain where the aqueduct may be compressed by a benign proliferation of the subependymal glia or by a tumour of the brain stem, pineal gland or vermis cerebelli. As the prognosis and treatment differ considerably in these various conditions, we commonly look to ventriculography for help in diagnosis. For various reasons, the interpretation of air shadows in this region is not always easy, or indeed possible, and we feel that any additional information about the pathological possibilities should be of importance.

This report deals chiefly with two cases of hydrocephalus in which the dilatation of the lateral ventricles was accompanied by rupture of the wall of the ventricle in the region of the vestibule, and the formation of a cyst-like space under the tentorium communicating with the lateral ventricle. The site of the rupture was identical in the two cases, and the ventriculographic appearances were similar. In both cases the hydrocephalus resulted from aqueduct obstruction, in one by proliferation of the subependymal glia and in the other by a fibrillary astrocytoma of the brain stem. We have also included the pathological report of a case of hydrocephalus due to adhesive arachnoiditis in which an early stage in the development of this process was seen.

Our interest in this abnormality began with an earlier case of stenosis of the aqueduct which had produced great dilatation of the third ventricle. The distended suprapineal recess protruded as a cyst-like swelling beneath the splenium, insinuating itself between the lower surfaces of the occipital lobes, and the upper surface of the cerebellum. Since then we have seen such dilatations in ventriculograms on a number of occasions and had come to regard the presence of a large suprapineal recess as evidence for an intrinsic lesion of the brain stem (benign stricture or tumour) as opposed to an extrinsic lesion such as a tumour of the superior vermis or of the pineal gland. The recess may be dilated in cases of obstruction in the distal part of the fourth ventricle too, but in these cases the aqueduct and fourth ventricle are generally dilated and it is fairly easy to demonstrate them in ventriculograms. In our first case, a large air-shadow beneath the tentorium was thought to be such a dilated suprapineal recess until it was shown at necropsy to be in communication with the lateral and not with the third ventricle.

Case Reports

Case 1. J.H. (R.I. 11851), a girl of 16 years, was admitted to the Radcliffe Infirmary on 4/11/40, complaining of headache. For two years she had been subject to attacks of headache lasting for four or five hours, occurring once or twice a month, with good health in the intervals. She occasionally vomited with the headaches, and for a year she had often been aware of a rhythmical noise in the head (which it was found could be stopped by compressing one or other carotid artery in the neck). The increasing frequency and severity of the headaches brought her to hospital; there were no other symptoms on direct enquiry.

On examination she was a healthy-looking girl normally developed and rather above the average intelligence. The skull was 54 cm. in circumference, slightly larger than normal. There was bilateral papilloedema, 3 D., but the visual acuity and fields were normal, except for slight enlargement of the blind spots. The pupils and ocular movements were normal, and there were no definite abnormalities in the examination of the rest of the nervous system. The spinal fluid pressure was 270 mm., and the fluid was normal on analysis. X-rays of the skull showed some convolutional thinning of the vault, early separation of the sutures, and some erosion of the sella turcica.

Comment.—This was thus a case of increased intracranial pressure with no definite localizing signs. Ventriculography revealed symmetrical dilatation of the lateral ventricles, and of the third ventricle with what was interpreted as a dilated suprapineal pouch (Fig. 1). The aqueduct could not be visualized distal to its upper end, and no air had got through to the fourth ventricle or cisterna magna. The appearances were regarded as being due to a stricture of the aqueduct, probably caused by proliferation of the subependymal glia.

At operation on the same day, 8/11/40, an incision was made in the lamina terminalis, by way of the right sub-frontal approach. The post-operative

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period was uneventful, and she was discharged from hospital on 28/11/40 free from symptoms. The osteoplastic flap was not tense, the spinal fluid pressure was 160 mm., and the papilloedema had virtually subsided.

She was well for two months, when she had a bout of pain in the right upper jaw which was eased by a dental extraction. At this time, the decompression

Fig. 1.—Case 1—First ventriculogram, showing small pouch below lateral ventricle.

was apparently flat, but as the pathological diagnosis had not been verified, we advised a course of deep X-ray therapy to the region of the brain stem. From the beginning of the treatment the decompression became more tense, the flap bulged, she developed a gradually progressive left hemiplegia, became very drowsy and incontinent. In that state she was readmitted on 6/5/41, 6 months after operation.

Clearly the fistula had not been effective, or, if it had, the lesion had progressed beyond the limit of compensation. The ventriculogram was repeated, and the ventricular dilatation was even more pronounced. The right frontal horn bulged with the decompression; but more striking was a large cystic collection under the anterior border of the tentorium (Fig. 2). This was an advanced stage of what had been seen six months earlier and had been regarded as a dilated suprapineal recess. Again no air was seen distal to the upper reaches of the aqueduct.

As the anterior fistula did not seem to have been effective, and as the presence of this pouch in the posterior fossa seemed to be an argument against a neoplasm in the cerebellum, we decided to open the pouch from behind, a sort of posterior ventriculostomy, hoping that a fistula between the third ventricle and the cisterna ambiens might be effective where one between the third ventricle and cisterna chiasmaticus had failed. By the usual cerebellar exposure, and retraction of the left cerebellar lobe downward from the tentorium, the cyst-like dilatation was seen and incised (Fig. 3). Although it was possible to explore the interior of this cavity by direct vision, the relations were confusing and anatomical landmarks could not be identified with certainty.

Again the post-operative phase was encouraging. Her general condition improved, the hemiplegia lessened, and the intracranial pressure, as judged by recession of the decompression and normal cerebrospinal fluid pressure, was satisfactory. On the morning of the ninth post-operative day she had two Jacksonian epileptic attacks down the left side of the body in quick succession, and died suddenly.

Pathological Examination

Summary of Necropsy.—Congestion of lungs. Internal hydrocephalus. Gliosis of iter. Operation: Ventriculostomy.

Bilateral pleural effusion ($\frac{1}{2}$ pint each side). Congestion of lungs; collapse of basal portions of

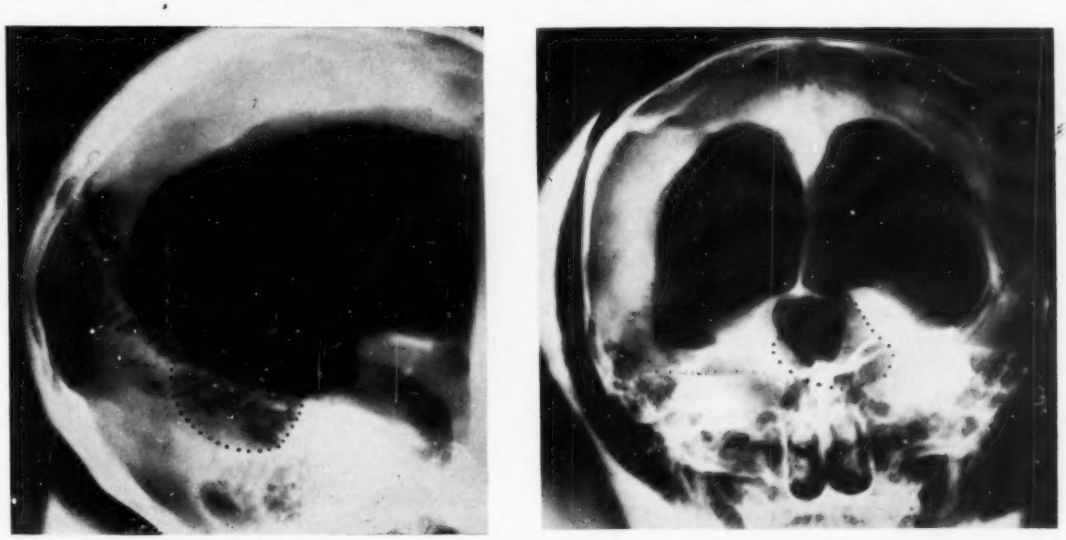


Fig. 2.—Case 1—Ventriculograms made 6 months later, showing increased size of cyst.

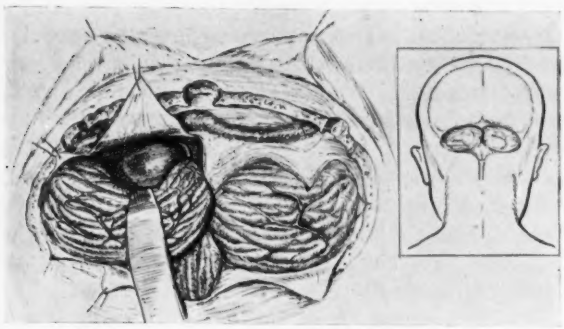
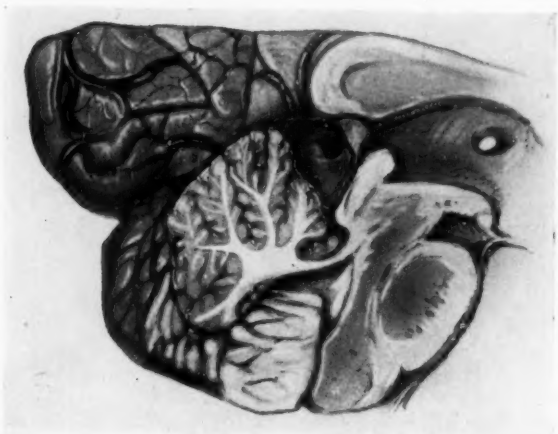


Fig. 3.—Case 1—Operation sketch.

lungs. Slight fibrous thickening of base of cusps of mitral valve. Calculous material in pelvis of left kidney; no further abnormality in abdominal organs. A few small cysts in colloidal thyroid gland.

Brain.—Macroscopic.—The cerebral hemispheres were considerably but unevenly expanded, the right frontal lobe bulging greatly at the site of the old craniotomy, which measured 8 by 4·5 cm. Apart from this area the meninges over the convexities of the brain appeared normal, except for slight subdural and subarachnoid hæmorrhage over the inferior surface of the right temporo-occipital region. In the meninges over the quadrigeminal plate was an empty space which measured 1·9 cm. from above down by 1·1 cm. in the mid-sagittal plane by about 2·2 cm. from side to side, and was bounded dorsally and laterally by a grey translucent fibrous membrane continuous with the arachnoid membrane. The roof of the space arched over the gap between the splenium and the anterior border of the vermis, lying beneath but in close relationship to the pineal body and the great vein of Galen (Fig. 4). An operative perforation, measuring 0·7 cm. in diameter, occupied the left side of the membrane. Internally the membrane appeared smooth and was sealed off everywhere from the adjacent cerebrospinal spaces, except at one point where it communicated with the left lateral ventricle by an orifice measuring 0·8 by 0·5 cm. This orifice was situated in the hinder part of the body of the ventricle, in the thin lamina of white matter that lies posterior to the fornix and medial to the hippocampal gyrus (Fig. 4). Its borders were smooth and rounded. At the same position in the right lateral ventricle was a dimple of similar size, but with no perforation in its depths. A ventriculostomy

(Top portion).



(Bottom portion).

Fig. 4.—Case 1—Sketch showing relations of cyst, aperture into left ventricle, and thinning of the corresponding part of the right ventricular wall.

opening measuring 0·4 by 0·3 cm., was present in the supraoptic recess. Delicate fibrous adhesions were attached to the borders of this opening, and the rupture of some of these during removal of the brain was followed by a gush of clear cerebrospinal fluid.

There was considerable dilatation of the third and lateral ventricles, the foramina of Monro being 0·8 cm. in diameter on either side. The right frontal horn was more voluminous than the left. The septum pellucidum was considerably fenestrated and the grey commissure elongated (1·2 cm.). The ependyma everywhere appeared thick and corrugated, but was smooth, glistening, and free from granulation. The choroid plexuses appeared normal. No lumen was visible throughout the anterior 0·6 cm. of the iter. The fourth ventricle was normal.

Microscopic.—The mid-brain was divided into four slices in the coronal plane and these, with the anterior end of the vermis in the mid-sagittal plane, the posterolateral border of the orifice in the left ventricle and portions of the third and fourth ventricles in the coronal plane were embedded in paraffin wax. Sections were stained with Ehrlich's hæmatoxylin and eosin, Weigert's iron hæmatoxylin and Van Gieson's mixture and with phosphotungstic acid hæmatoxylin.

The lumen of the *iter* is subdivided into a number of small irregular channels by a dense cellular and fibrillary gliosis which extends into, without expanding, the quadrigeminal plate, diminishing towards its dorsal surface but becoming intensified again in the marginal glia. The gliosis encroaches ventrolaterally on the borders of the nucleus of the third nerve on the left, but the right nucleus is free. The greater part of the iter is so involved, and even where at either end of its course the lumen is of normal outline there is excessive thickening of the dorsal subependymal glia extending into the quadrigeminal plate. In most places the subdivisions of the lumen are lined with a well-preserved, ciliated ependyma; a few areas are denuded. A few blood vessels in and near the hyperplastic glial tissue show slight cuffing with small lymphocytes.

The border of the orifice in the left lateral ventricle is formed by an everted tapering fringe of the subependymal glia which is of normal appearance. The ependyma covering the fringe and the adjacent wall of the ventricle is absent in many places. Over some of the denuded areas there are groups of degenerating leucocytes and macrophages containing red corpuscles; occasional macrophages containing iron pigment occupy the superficial layers of subependymal glia. The adjacent leptomeninges are thickened by young fibrous tissue and sparsely infiltrated with lymphocytes, desquamated arachnoid cells, and neutrophil leucocytes. At a little distance from the orifice, corresponding to the margin of the space in the cisterna ambiens, there is an abrupt change to normal. A similar thickening and infiltration affects the meninges walling this space over the quadrigeminal plate and the anterior border of the vermis.

Short strips of the ependyma of the third ventricle are missing in some areas, and in other places there is focal degeneration and necrosis of a few contiguous cells, such points often being overlaid by a small cluster of macrophages containing red corpuscles together with degenerating polymorphonuclear leucocytes and eosinophil cellular debris. At some of the denuded spots the subependymal glia protrudes slightly towards the lumen. The appearances suggest an early stage of granular ependymitis. In the fourth ventricle the ependyma is of normal appearance. The leptomeninges over the brain stem are sparsely infiltrated with desquamated arachnoid cells and neutrophil leucocytes, and contain some free red corpuscles.

Summary.—The hydrocephalus in this case was due to gliosis of the iter. As in other similar cases there was no histological evidence pointing to the ætiology of this condition. The scanty perivascular lymphocytic infiltration seen in a few vessels in and near the gliosis was probably in direct association with the slight chronic inflammation of the adjacent meninges. This infiltration doubtless resulted from breaking down of tissue at the site of the communication between the left lateral ventricle and the leptomeninges over the quadrigeminal plate. Subsequent operative procedures, with the freeing of red corpuscles and small amounts of cellular debris into the cerebrospinal fluid promoted a slight meningeal and ependymal reaction as seen over the brain stem and the lining of the third ventricle respectively.

Case 2. B.B. (R.I. 16954), a female aged 20 years, was admitted on 25/7/41, complaining of severe headache. For two years she had been subject to attacks of headache and vomiting, coming on in the early morning, lasting for several hours, and then clearing up completely. These headaches occurred almost daily, with rare intervals of freedom up to a fortnight, and they made it necessary for her to give up her career of nursing. A short time before admission she had had two or three especially severe attacks in which the headache was accompanied by a transient loss of contact with her surroundings, a feeling of weakness of all her limbs, and some difficulty in speaking, which was probably a dysarthria. The only other symptom of significance was in connection with menstruation: the menarche occurred at 16 years and she had had only three scanty periods from that time.

On examination, she was a tall young woman with the facial appearance of mild acromegaly, but there was no enlargement of the hands or feet. The secondary sexual characteristics were normally developed. She was alert and intelligent, and during the week of observation in hospital she complained of very severe headache, and vomited on three occasions. There was no enlargement of the skull. The sense of smell was impaired in each nostril, but it was not lost. There was bilateral papilloedema of three diopters, but the visual acuity and fields were normal, except for slight enlargement of the blind spots. The pupils and ocular movements were normal, but there were a few nystagmoid jerks at the extremes of lateral deviation. There was no definite weakness, tremor, or ataxy in her face, trunk, or limbs. The reflexes were all normal and there was no sensory defect. Lumbar puncture revealed clear, colourless spinal fluid under a pressure of 300 mm. The fluid contained 30 mgm. of protein and no cells. X-rays of the skull showed some convolutional thinning, early separation of the sutures, and gross erosion of the sella turcica.

Comment.—As in the first case, the problem was one of increased intracranial pressure without localizing signs, and ventriculography revealed gross ventricular dilatation with a large pouch extending backwards under the tentorium (Fig. 5). No air was seen distal to the upper part of the aqueduct.

This appearance was recognized as being similar to that described in Case 1, and the same kind of procedure was decided on—i.e., cerebellar decompression and incision of the cyst below the tentorium. This operation was done under general anæsthesia without incident. She died seven hours later from a large extradural hæmorrhage over the right cerebral hemisphere.

Pathological Examination

Summary of Necropsy.—Extradural hæmatoma. Internal hydrocephalus. Astrocytoma of mid-

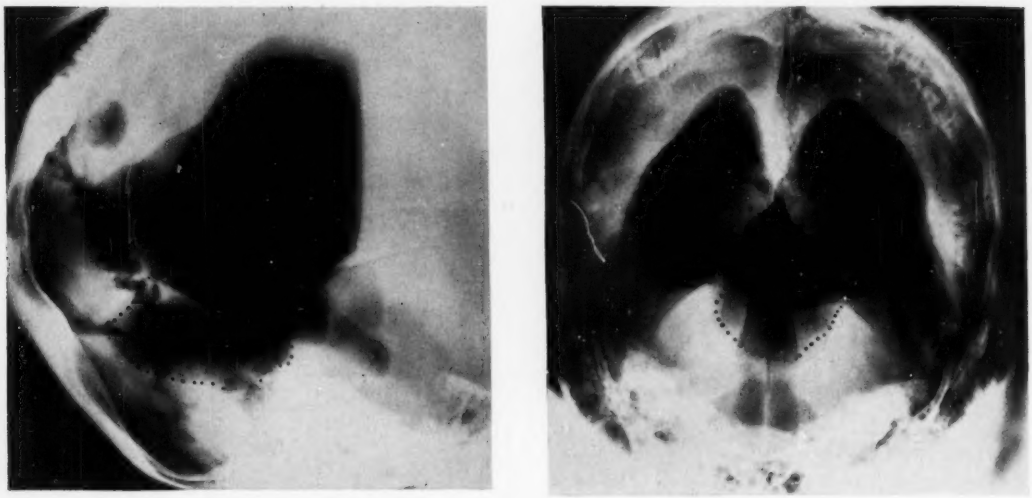


Fig. 5.—Case 2—ventriculograms showing outlines of cyst below tentorium and aperture into left ventricle.

brain. Operations: suboccipital craniotomy and ventriculography.

Recent hæmatoma, measuring 12 cm. anteroposteriorly by 9 cm. above down and up to 2·5 cm. deep between dura and cranium over right frontoparietal region, apparently caused by rupture of vein emerging from dura in region of one of the lacunæ laterales. Slight flattening from above downwards of otherwise normal pituitary body. No further abnormalities in endocrine system. A few atretic follicles and no corpora lutea in ovaries. Atrophy of endometrium in rather small uterus (body 3 cm. long; cervix 2·8 cm. long). Slight congestion and parenchymatous degeneration of liver. A few acute erosions (1·5 by 1 cm.) in œsophagus. Slight atheroma involving mitral valve and aortic ring. Slight dilatation and hypertrophy of both ventricles of heart. Subendocardial hæmorrhages in left ventricle. Moderate congestion and œdema of lungs. A well-developed, slightly adipose woman.

Brain.—Macroscopic.—The hæmatoma had caused great flattening of the right cerebral convexity, but the left cerebrum was of good shape, its contours being full and rounded. The floor of the third ventricle formed a translucent balloon filling the interpeduncular space and measuring 3·0 by 2·2 cm. There was a cerebellar pressure-cone 2·0 cm. long. Over the quadrigeminal plate the arachnoid membrane was elevated to form a space, about 3·0 cm. in diameter, which extended over the anterior end of the vermis for a distance of about 2 cm. The membrane contained several oval openings, corresponding to those made at operation. Elsewhere the space appeared to be sealed off from the cerebrospinal pathway, except where an oval orifice, 1·0 by 0·7 cm., led into the cavity of the left lateral ventricle in a position identical with that observed in Case 1 (Fig. 6). There was no corresponding opening or dimple on the right side, but the tissue here was thin and translucent. The margins of the orifice were smooth and rounded, except along its medial border, which was occupied by a crescentic flange of translucent tissue up to about 2 mm. wide. Both lateral ventricles were equally and considerably dilated, the foramina of Monro measuring 1·5 by 1 cm. The septum pellucidum was fenestrated. The ependyma everywhere was somewhat thickened and discoloured by hæmolytic staining. In places there were small abrasions and recent subependymal hæmorrhages resulting from puncture wounds, especially in the occipital horns.

On section the quadrigeminal plate was expanded into a smooth, dome-shaped mass, about 1·5 mm. dorsiventrally and 2 cm. from side to side, of poorly defined rubbery milky-white tissue. The mass involved the right side rather more than the left. The whole length of the iter was greatly compressed and displaced ventrally and to the left. The pineal body was intact and lay in the dorsal wall of the meningeal space over the mid-brain. The fourth ventricle was normal.

Microscopic.—The tissue examined and stains used were as in Case 1. The quadrigeminal plate is greatly expanded by a tumour composed of fibrillary astrocytes which form, in many places, interlacing bundles of elongated bipolar cells and elsewhere less dense areas in which small stellate cells form small groups separated by a feltwork of their interlacing processes. In the depths of the mid-brain the tissue is often more cellular, the nuclei being in general larger and uneven in size. A few multinucleate cells are present. The borders of the tumour are moderately defined through the circumferential arrangement of the cells in these parts. There is extensive invasion by tumour cells of the leptomeninges over the dorsal surface of the mid-brain and a similar invasion of the Virchow-Robin space of some of the perforating vessels in this region. On the left ventrolateral border of the tumour the aqueduct is deformed to an oblique slit. Its ependyma has been partly replaced by tumour cells.

The appearances of the orifice in the left lateral ventricle are similar to those described in Case 1. The corresponding imperforate area in the right ventricle is occupied by a lamina, about 0·6 mm. thick, of ependyma and subependymal glia. The appearances of the nervous tissues are normal, apart from loss of the ependymal cells in many areas. There is slight fibrosis of the adjacent meninges with a considerable collection of red corpuscles, fibrin and few neutrophil leucocytes in the meshes of the pia. The leptomeninges forming the wall of the cystic space over the mid-brain show fibrous thickening and sparse infiltration with lymphocytes and desquamated cells as in Case 1. There is, in addition, some infiltration with neutrophil leucocytes. Over the ventral aspect of the brain stem the reaction is limited to slight focal leucocytic infiltration.

Summary.—This case resembles Case 1 in the formation of an opening between the left lateral ventricle and the leptomeninges as a mechanical consequence of internal hydrocephalus. The communication was found at the same site, and the

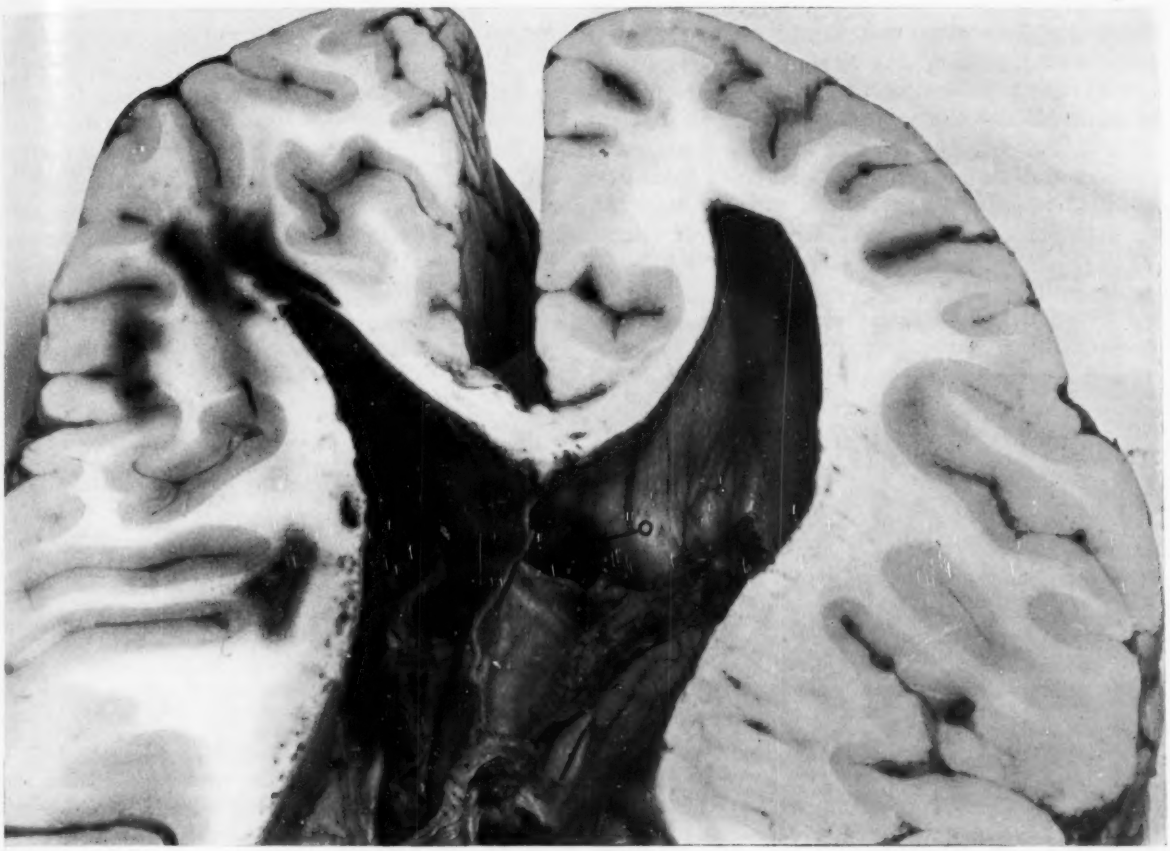


Fig. 6.—Case 2—Arrow indicates aperture in floor of left ventricle.

corresponding area in the right ventricle was of translucent thinness. The cause of the hydrocephalus here was a fibrillary astrocytoma of the quadrigeminal plate which deformed the iter; in Case 1 a gliosis of the iter was responsible. In the literature these two types of lesion have often been confused, but, though we have insufficient evidence to deny categorically the neoplastic character of aqueductal gliosis, there are certain features on which we may base a distinction in the present two cases.

1. *Macroscopic expansion and deformity of the mid-brain.*—This was absent in Case 1, but a definite feature in Case 2.

2. *Subdivision and displacement of the aqueduct.*—In Case 1 subdivision was conspicuous, but the aqueduct occupied its normal position in the mid-line; in Case 2 the aqueduct was displaced and deformed, but not subdivided.

3. *Cytological features of neoplastic growth* were not seen in Case 1. In Case 2 we observed invasion by fibrillary astrocytes of the meninges and Virchow-Robin spaces of blood vessels, also variations in the morphology of the cells with occasional multinucleate giant cells.

The distinctions indicated in 1 and 2 are probably of greater value than those in 3.

Case 3. G.H. (R.I. 19190), a female child aged three years, was admitted on 3/11/41, suffering from advanced hydrocephalus which dated from early infancy and was at first thought to be congenital. There was a story of a febrile illness at the age of three weeks, and although the details were not sufficiently clear to establish its nature with certainty, it probably was a meningeal inflammation. The child was brought to hospital because of progressive enlargement of the head, and inability to sit or stand. She was a fat, healthy-looking child, with a very large head, 61·5 cm. in circumference. Her mental development seemed to be normal as judged by speech and behaviour. There was low-grade papillœdema with normal visual acuity and full fields. There were no abnormalities in the pupils or ocular movements, nor in the other functions subserved by the cranial nerves. The limbs were slightly hypertonic and generally weak, but there was no definite ataxy. All the tendon reflexes were brisk, and both plantar responses were extensor. There seemed to be no disturbance of sensibility to pin-prick and cotton wool. The spinal fluid pressure was 240 mm. and the fluid contained 60 mgm. protein and 2 cells. X-rays of the skull showed gross separation of the sutures. A ventriculogram revealed a gross dilatation of the whole ventricular system including the 4th ventricle.

Comment.—It was thought that the hydrocephalus resulted from adhesive arachnoiditis which had occluded the foramina in the fourth ventricle. At operation on the same day an incision was made in the lamina terminalis by the right frontal approach. The post-operative period was marked by hyperpyrexia, tachycardia, and other features seen after ventriculography in cases of advanced hydrocephalus and she died on the sixth day.

Pathological Examination

Summary of Necropsy.—Internal hydrocephalus. Chronic meningitis. Operation: Ventriculostomy.

There were no significant changes in chest or abdomen. The dura was firmly sutured over a craniotomy opening, 4·5 by 3 cm., in the right frontal region. The anterior fontanelle was patent, measuring 12 cm. from side to side and 9 cm. antero-posteriorly. The skull was greatly expanded and translucent, the bone being from 0·2 to 0·3 cm. thick. A little muco-pus was present in the left middle ear.

Brain.—Macroscopic.—Both cerebral hemispheres were greatly and symmetrically expanded and their meninges engorged. There was slight diffuse subarachnoid hæmorrhage over the occipital lobes corresponding to the

Fig. 7.—Case 3—Arrow indicates translucent area in floor of right lateral ventricle.

burr-holes made for ventriculography. A patent ventriculostomy opening, measuring 0·7 cm. in diameter, occupied the anterior wall of the third ventricle. There was grey gelatinous thickening of the leptomeninges over the whole of the brain stem, forming a pouch with well-defined borders over each foramen of Luschka. In the basal and interpeduncular cisterns and the proximal parts of the Sylvian fissures a similar thickening was accompanied by brownish discoloration. The arachnoid membrane roofing the cisterna magna was firmly adherent to the dura mater near the mid-line, its margins being thickened and slightly opaque. This cistern was greatly expanded, measuring 3 by 2 by 1·5 cm. in depth, and the foramen of Majendie was so large (1·1 by 0·7 cm.) that the hind-end of the aqueduct could be viewed through it. The whole of the ventricular system was greatly expanded, the aqueduct measuring 0·7 by 0·5 cm. in cross-section. The right lateral ventricle however was slightly larger than the left and the latter was incompletely divided, at the level of the vestibule, by a falciform septum with a translucent, slightly fenestrated free medial border which extended from the dorsal surface of the choroid plexus to unite with the roof. This plexus was smooth, grey, and opaque as though embedded in fibrous tissue, and from it extended a thin filament of similar grey tissue uniting with the medial wall of the ventricle (Fig. 7). A similar filament traversed the cavity of the third ventricle parallel with the anterior and grey commissures. Apart from a fine morocco-leather granularity of the ependyma over the basal ganglia the walls of the ventricle were smooth, ivory white, and corrugated. In the right lateral ventricle the site of the orifice leading into the leptomeninges observed in Cases 1 and 2 was occupied by a sharply defined oval translucent membrane, measuring about 1 by 0·6 cm. This was rendered conspicuous in photographing the specimen by placing a bright light behind it (Fig. 7).

Microscopic.—The translucent area in the hind-part of the right ventricle, illustrated in Fig. 7, is formed by a membrane, from 87·5 to 105 μ thick, of fibrillary glia. The ependyma has been lost from its ventricular surface and is interrupted over the adjacent hippocampal gyrus. The leptomeninges covering the outer aspect of the membrane are normal apart from a sparse infiltration with desquamated arachnoid cells, lymphocytes and a few neutrophil leucocytes.

The septum in the left lateral ventricle is composed of vascularized neuroglial tissue devoid of inflammatory infiltration except where it unites with the choroid plexus. The latter is embedded in a richly vascularized layer of neuroglial and collagenous tissue infiltrated with a few lymphocytes and small groups of macrophages many of which contain iron pigment. The anterior aspect of the lateral extremity of the septum and adjacent parietal wall of the ventricle are denuded of ependymal cells; a few short strips of these cells are present on the posterior surface of the septum where it approaches the ventricle wall.

The leptomeninges, especially the arachnoid membrane, over the brain stem and cisterna magna are thickened by fibrosis and infiltrated with numerous desquamated arachnoid cells, many of which have ingested red corpuscles, while a few contain granules of iron pigment. Free red cells and sparser leucocytes and lymphocytes are also present. The arachnoid membrane over the cisterna magna is united to the dura by fibrous tissue and here the arachnoid cells have proliferated to form sheets over the collagenous trabeculæ. The fibrosis does not extend however over the lateral lobes of the cerebellum, though phagocytic activity of the arachnoid cells is evident and is accompanied by a sparse infiltration with neutrophil leucocytes. There are numerous ependymal granulations in the lining of the fourth ventricle.

Summary.—Internal hydrocephalus is due, in this case, to chronic leptomeningitis of unknown ætiology. Birth trauma is unlikely to have been the cause since there is little evidence of old hæmorrhage; the small amounts of iron pigment present in the meninges over the brain stem, as well as the free and ingested red cells, may be attributed to the operation performed five days before death. It is possible that the febrile illness at the age of three weeks was a low-grade meningitis. The observation of expansion of the skull from this time onwards is in support of this view. There is insufficient evidence to indicate the origin of the septum and filaments within the ventricles.

The dilatation of the lateral ventricles was greater than in Cases 1 and 2, but the concomitant expansion of the skull probably prevented the intra-ventricular pressure from reaching the levels attained when the sutures are closed.

General Comment

These cases demonstrate an unusual sequel of hydrocephalus which may be commoner than we have realized. Its importance lies chiefly in the interpretation of ventriculograms—and recognition of its nature should be of guidance in the surgical treatment of cases such as we have described.

The cystic collection in the leptomeninges was at first regarded as a diverticulum of the third ventricle until necropsy studies showed that it was in communication with the lateral ventricle. Further examination has shown that it is not a diverticulum

of the ventricle, but a collection of cerebro-spinal fluid which escapes into the leptomeninges through a rupture of the wall of the ventricle. The rupture occurs in that part of the wall which is thinnest normally, i.e. in the medial angle of the collateral trigone (the floor of the ventricle) which lies between the forward-sweeping crus of the fornix, and the forceps major. In this region the ventricular wall is not supported by any appreciable thickness of white matter, nor by the basal ganglia, nor by any strong vascular network such as the choroid plexus. The effect of ventricular dilatation is to stretch this weak spot by increasing the angle between the crus of the fornix in front and the forceps major behind, and to make it even more thin. The rupture then takes place, and cerebrospinal fluid escapes beneath the pia. It is presumably the connection of the pia to the surface of the brain which limits the extent of the extracerebral collection of fluid to a cyst-like cavity. This enlarges into the most accessible space, i.e. in the incisura tentorii, and thus insinuates itself between the tentorium above, and the upper surface of the cerebellum and brain stem below. As it does so, it pushes the arachnoid before it, and the cyst can thus be said to be in the subarachnoid space. Passing through the incisura tentorii it occupies the upper part of the cisterna ambiens, and acting as a fluid plug it probably adds to the already existing obstruction by embarassing the return of cerebrospinal fluid from the posterior fossa to the supratentorial compartment. In neither of our cases did we detect any neurological signs which could be referred to direct pressure of the cyst on neighbouring structures.

That this process is not a diverticulum of the ventricle seems to be shown by our third case in which the wall of the ventricle was thinned to translucency, but there was no protrusion as would be expected in the early stages of the development of a diverticulum. The thinning may be bilateral but in our cases the rupture occurred only in one ventricle. Childe and McNaughton (1942) have recently reported a case of bilateral loculi of this nature which they speak of as ventricular diverticula, but they recognize the essential feature as being rupture of the ventricular wall. Sweet (1940) has also described a similar case discovered at autopsy, and he suggested the term " ventriculostium."

The treatment should be directed to the cause of the obstruction if that is possible. In cases of benign stricture of the aqueduct and neoplasm of the brain stem, we may have to be content with procedures which we hope will short-circuit the circulation of the cerebrospinal fluid around the obstruction. In many cases, anterior third ventriculostomy is effective and this is probably the procedure which should be tried first. If it is not effective, as in our first case, and subsequent ventriculograms show that the cyst is large enough to be accessible by a cerebellar approach, it seems reasonable to attack it from behind. Theoretically, collapse of the cyst should open up the cisterna ambiens, and fluid should escape directly from the lateral ventricle into the subarachnoid space without having to traverse the third ventricle. It should be said, however, that in both of our cases there was evidence of chronic inflammation in the walls of the cyst which had produced local adhesions in the subarachnoid space, and it is possible that these adhesions might limit the efficacy of such an opening. As both of our cases died before they had recovered from the immediate effects of the operation, it is difficult to assess the value of the procedure, but we feel that it is worth a further trial.

It is possible that this process affords an explanation of some cases of hydrocephalus which seem to be arrested spontaneously. If the rupture of the ventricular wall is accompanied or followed by rupture of the pia, the fluid will escape directly into the subarachnoid space and we could speak of a spontaneous ventriculostomy. This event would be more likely in the case of a static or slowly progressive lesion such as benign stricture of the aqueduct than in the case of a neoplastic process.

References

Childe, A. E. and McNaughton, F. L. (1942). *Arch. Neurol. Psychiat., Chicago*, **47**, 768.
Sweet, W. H. (1940). *Ibid.*, **44**, 532.

EROSION OF THE ALA NASI FOLLOWING TRIGEMINAL DENERVATION

BY

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(RECEIVED 9TH APRIL, 1943)

Introduction

It is the purpose of the present paper to draw attention for the first time to a clinical syndrome observed in a series of eight patients in whom anæsthesia of the skin supplied by one trigeminal nerve had been produced either by retroganglionic section of the root fibres or by the injection of alcohol into the Gasserian ganglion. The most striking feature in seven of the eight cases was an erosion of the numb nostril. Allied with this were paræsthesiæ, self-inflicted trauma, epistaxis, nasal fissures, and facial ulcers. The following table analyses the frequency with which these phenomena were met with in the present series.

Six of the eight patients complained of unpleasant sensations in the anæsthetic half of the face and seven admitted to having rubbed, picked, or otherwise traumatized the numb skin, particularly the nostril. It is the thesis of the present communication that the patients injured the anæsthetic skin in an attempt to rid themselves of paræsthesiæ and that this is the main mechanism in the evolution of the skin lesions; tissue inferiority due to advanced age and superimposed infection very probably influence their course. It is the writer's belief that trauma not only affects a numb area more intensely and more frequently but that the response of an anæsthetic part to injury differs from that of the normal. A full discussion, however, concerning the trophic function of sensory nerve fibres lies outside the scope of the present clinical report.

Case Reports

Case 1. W. C., aged 70 years, male.

Trigeminal neuralgia. Alcohol injection into right Gasserian ganglion. Keratitis right eye. Erosion right ala nasi. Ulcers on right side of face.

The patient presented himself for examination in August 1941, ten years after the right Gasserian ganglion had been injected with alcohol. The injection was followed by complete and lasting anæsthesia of the right side of the face and by freedom from pain. Keratitis which threatened the right eye some days after the injection was successfully treated by tarsorrhaphy. From the date when the right side of the face was rendered anæsthetic the patient was uncomfortably aware of his breathing, for the right nostril seemed to him to be blocked. He concluded that crusts had formed in the nostril and when he attempted to pick them out the nostril bled. In the years that followed, the right ala nasi gradually became thinner and wore away, but in the months preceding this examination the process had been accelerated.

About May 1941 a small, superficial ulcer appeared on the right upper eyelid, another on the right cheek and a third on the skin of the right lower jaw. The last of these healed with the application of ointment and left no scar; the other two were still present three months later. They appeared as superficial erosions of the dermis, their floor was covered with dried serum and blood and their edges were sloping and soft. The skin adjacent to the ulcers showed no inflammatory reaction. The condition of the right nostril can be appreciated from Fig. 1. The loss of substance included the whole thickness of the anterior half of the ala and extended into the skin immediately above. The edge of the skin defect was covered with epithelium, but posteriorly at the junction of the ala with the floor of the nose there was a fissure covered with a slough. There was no enlargement of lymphatic glands and although the patient was unusually thin he had not recently lost any weight.

TABLE I

Case	Age	Sex	Paræsthesiæ	Trauma	Epistaxis	Fissure	Erosion	Ulcers	Keratitis	Anæsthesia of divisions	Operation
1 W.C.	70	M	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1, 2, 3.	Alcohol injection
2 S.McD.	46	F	Yes	Yes	Yes	No	Yes	Yes	Yes	1, 2, 3.	Root section
3 D.P.	65	F	Yes	Yes	Yes	No	Yes	Yes	No	1, 2, 3.	Alcohol injection
4 E.R.	61	M	Yes	Yes	Yes	Yes	Yes	No	No	1, 2, 3.	Alcohol injection
5 J.B.	49	M	Yes	Yes	Yes	Yes	Yes	No	Yes	1, 2, 3.	Alcohol injection
6 A.S.	58	F	No	Yes	Yes	Yes	Yes	Yes	No	1, 2, 3.	Alcohol injection
7 A.E.	50	F	Yes	Yes	Yes	Yes	No	No	No	(1), 2, 3.	Root section
8 E.H.	40	F	Yes	Yes	Yes	No	Yes	Yes	Yes	1, 2, 3.	Removal acoustic neuroma

Analysis of the eight cases forming the material of the present series.

A year following this examination the man died and his medical attendant stated in answer to an enquiry that death had been due to myocardial degeneration. More ulcers had appeared on the right side of the face and had bled. The condition of the right nostril had remained stationary.

Comment.—Many features presented by this case will reappear in the descriptions of the other patients in this series. The anæsthesia of the right side of the nose and the inability to appreciate the passage of an air-current very naturally led the patient to conclude that the nostril was occluded. In much the same manner the failure to recognize movements of the anæsthetic portion of the face is frequently rationalized as "stiffness" or "swelling." The

FIG. 1.—The appearance of Case 1, ten years following an alcohol injection of the right Gasserian ganglion.

phrases "crust formation" and "blocking of the nose" may not at first have formulated themselves in the patient's conscious mind, but he picked his nose as if it were actually obstructed. Epistaxis followed the self-inflicted trauma which, applied to an insensitive area, may have been excessive, and the hæmorrhage probably originated from the fissure between ala and floor of nose rather than from the septum. In four other cases of the present series a similar fissure was observed at the same site. Repeated gross trauma appears as the only obvious explanation of the progressive erosion of the nasal wing, but it seems unlikely that normally sensitive skin would react in this manner if it were subjected to similar mechanical stimulation. The skin defect was not surrounded by an area of inflammation and neither swelling nor redness were observed in any of the other cases whose alæ nasi had become eroded. This negative finding suggests that the absence of the protective and reparative processes which are associated with inflammation may to some extent account for the progressive destruction of the anæsthetic ala.

The ulcers on eyelid, cheek and lower jaw were not typical of any of the commoner skin diseases. They looked as if the superficial layers of the skin had been rubbed away without causing an inflammatory response. This may in fact have happened, but no history of trauma could be obtained. Strange that the ulcers should have appeared ten years after the alcohol injection at the same time as the erosion of the nostril increased. One might speculate *a priori* that an anæsthetic skin area would be among the first tissues to show the effect of a lowering of general vitality and reduction of regenerative powers due to advanced age. Possibly the transfer of infected material from the nose onto the face by the patient's finger might have caused the ulcer.

Case 2. S.McD., aged 46 years, female.

Trigeminal neuralgia affecting the right second and third divisions. Partial root section 1935. Total root section 1936. Erosion right ala nasi. Ulceration right side of face.

FIG 2.—Case 2.

A fractional division of the root of the right trigeminal nerve was performed in 1935 and resulted in complete anæsthesia of the third and patchy anæsthesia of the second division. A year later the patient complained of neuralgic pain in the right eye and right side of the nose. The remaining root fibres were divided at a second operation, which produced anæsthesia in all three divisions. Immediately following the operation a few herpetic vesicles appeared on the upper lip; the eruption cleared up after a few days. The right cornea became œdematous, a small ulcer formed in its centre and since conservative treatment failed to check its progress a tarsorrhaphy was performed.

She presented herself for examination four years later with a well-marked triangular defect of the right ala nasi (Fig. 2). The patient claimed to have first noticed the nasal erosion at the time when the tarsorrhaphy was performed in 1936 at another hospital about three weeks after the root section. She also complained of a recurrent swelling on the right side of the nose near the inner canthus of the eye. Frequently superficial ulcers developed on the right side of the face and healed without leaving a scar. She volunteered the information that she could not lie on her left side without becoming distressed by a choking sensation. She admitted that she occasionally picked her nose and made it bleed.

Comment.—The patient was examined by ophthalmic and nasal surgeons, but no local cause was

found to account for the recurrent swelling of which the patient complained. It may be surmised that the swelling was really a subjective sensation, particularly as the patient has not attended again although she was asked to do so should the nose swell. The distress which lying on the left side caused her may equally be regarded as the result of the anæsthesia and failure to appreciate air passing through the right side of the nose. Self-inflicted trauma, epistaxis and recession of the ala nasi were again prominent features in this case and facial ulcers had been noticed by the patient, but had not been objectively verified.

Case 3. D.P., aged 65 years, female.

Trigeminal neuralgia affecting right second division. Alcohol injection of ganglion producing complete anæsthesia of all three divisions. Epistaxis, recession of anæsthetic nasal wing.

In 1936 this patient had the first attack of major trigeminal neuralgia confined to the second division on the right side. In 1938 the Gasserian ganglion was injected with alcohol and anæsthesia of the whole right side of the face resulted. Some days later the right eye became blood-shot, but the hyperæmia subsided with conservative treatment. A fortnight or so after her discharge from hospital she began to lose blood from the right nostril; the hæmorrhage was at times profuse and for more than a year it occurred several times a week. She was in the habit of placing a handkerchief on her pillow at night to absorb the blood. A red patch later appeared on the border between upper lip and floor of nose and gradually spread upward and downward. The patient herself thought that this raw area had been produced by the frequent rubbing of her lip and nose to wipe away blood. Six months following the injection she first noticed that the nostril had shrunk and when she presented herself for examination about a year after the injection the erosion was very marked (Fig. 3). She was advised to pack the nostril gently with vaseline gauze but to refrain from otherwise touching it. Five weeks later she reported that the epistaxis had become much less and that the nasal ulcer was healing. In 1942 she stated in answer to an enquiry that she had had no further hæmorrhage, and the erosion of the nostril had not progressed.

FIG. 3.—Case 3.

Comment.—This patient did not complain of paræsthesiæ but the connection between self-inflicted trauma and the superficial ulcer at any rate is obvious.

Case 4, E.R., aged 61, male.

Sixteen years bilateral trigeminal neuralgia treated by repeated alcohol injections. Epistaxis left nostril, ulceration and retraction of left nasal wing. Fissure along floor of nose.

Sixteen years ago this man had the first attack of trigeminal neuralgia on the left side of the face. Five years later the left Gasserian ganglion was injected with alcohol and recurrence of the neuralgia made five more injections necessary during the subsequent four years. Following the last injection, seven years ago, he remained free from pain on the left side of the face. One year after this last ganglion injection he complained of an itching sensation in the left nostril; he rubbed and scratched the nose and one day "burst a blood-vessel." An ulcer appeared on the floor of the nose and in time the left nasal wing became shorter. When he presented himself for examination the appearances were those recorded in Fig. 4. A fissure extended for about 1 cm. along the floor of the nose at its junction with the ala. The remnant of the ala felt thickened and the skin adjacent to the defect was a little dusky. Anæsthesia was still complete in the area supplied by the first division, but pin-prick was appreciated as light touch in the areas supplied by the second and third divisions.

In the light of what has been said before the foregoing case appears as a very typical example of the syndrome and no comment appears necessary. The following two cases are examples of very early stages of the condition.

Case 5. J.W.B., aged 49 years, male.

Right-sided trigeminal neuralgia affecting the second and third divisions. Alcohol injection of ganglion. Keratitis. Paræsthesiæ, epistaxis, nasal fissure, erosion right nasal wing.

Some weeks following an alcohol injection of the right Gasserian ganglion which had produced numbness of the whole trigeminal area the patient noticed a small fissure at the junction of nasal wing and upper lip. His attention was first drawn to it when the nose bled, but he could not say for certain whether or not he had first scratched his nose. He had, he said, noticed an itching of the left nostril and had at times attempted to free the nostril by picking it and by removing scabs and blood clot. When he presented himself for examination six months after the injection there was a Y-shaped fissure in the anterolateral portion of the floor of the nose and the crack extended onto the upper lip. The ala was slightly elevated and on the skin covering it there were a number of teleangiectatic vessels which were not present on the opposite side. Examination of the nasal passages revealed no abnormality. The patient was advised to keep the fissure covered with vaseline and to refrain from touching the nose. When he was seen a month later the fissure was noticeably smaller and epistaxis had ceased.

Comment.—One cannot tell whether in time this nostril will shrink as much as the others in this series have done. Keeping the fissure covered with ointment and preventing the patient from traumatizing it should cure the condition if self-inflicted trauma really is the most important single factor. It is, however, possible that once the insensitive nostril has begun to shrink through trauma a train of tissue changes has been set in motion which cannot be halted by protecting the part.

Case 6. A.S., aged 58, female.

Left trigeminal neuralgia. Ganglion injected with alcohol. Total anæsthesia all three divisions. Epistaxis, ulceration, fissure and elevation of left nasal wing.

In November 1939 the patient's left Gasserian ganglion was injected with alcohol to cure a trigeminal neuralgia which had for 15 years affected the second and third divisions. Total anæsthesia of all three divisions resulted. Three months later the patient attended the hospital complaining of daily epistaxis and of ulceration of the floor of the nose and the upper lip on the left side. She had had no paræsthesiæ, but she had frequently rubbed the nostril and dabbed it to stop the bleeding and to clear it from clot. For six months the area of superficial ulceration continued to increase in size in spite of the application of Ung. hyd. amm. dil., but since treatment was carried out in another department of the hospital it is not known whether the patient was told to refrain from touching the nose. She was seen again a year following the injection. By then the ulcer had healed, but a fissure was present on the floor of the nose and the left nasal wing was slight elevated. Epistaxis

FIG. 4.—Case 6. Note the beginning of shrinkage of the ala nasi and the absence of inflammation in the skin surrounding the ulcer.

had ceased. The patient has not attended since and has not replied to enquiries regarding her progress. It may be assumed that the neuralgia has not recurred.

Comment.—The case is an important one in the series, but unfortunately it is not as well documented as one would wish. Epistaxis, ulceration, nasal fissure, and elevation of the nasal wing were all present suggesting once again that these factors are causally related. No clear history concerning self-inflicted trauma was obtained when the patient attended hospital, and she has left repeated enquiries unanswered. It is impossible therefore to say whether the elevation of the ala progressed in the absence of injury.

Case 7. A.E., aged 50 years, female.

Trigeminal neuralgia right second and third divisions. Partial root section. Epistaxis, nasal fissure.

In June 1942 a fractional division of the right trigeminal root was performed by the temporal approach. The areas supplied by the second and third divisions were rendered completely anæsthetic; sensation in the right side of the forehead and right eye was depressed, whilst the right side of the nose including the ala was completely anæsthetic. The operation was an unusually difficult one, the dura stripped badly and a good deal of bleeding had to be dealt with. Eleven days after the operation the patient noticed a "trickling" sensation down the right side of the nose and in the right nostril. She rubbed the nose and the right nostril bled. About a month after the operation a small fissure between ala and upper lip was detected by the patient and she presented herself for examination. The patient was examined by a nasal surgeon who found no abnormality in the mucous membrane of the right nostril, apart from a small ulcer on the anterior end of the inferior turbinate bone on the right. There was no inflammation, no swelling and the ala was not elevated.

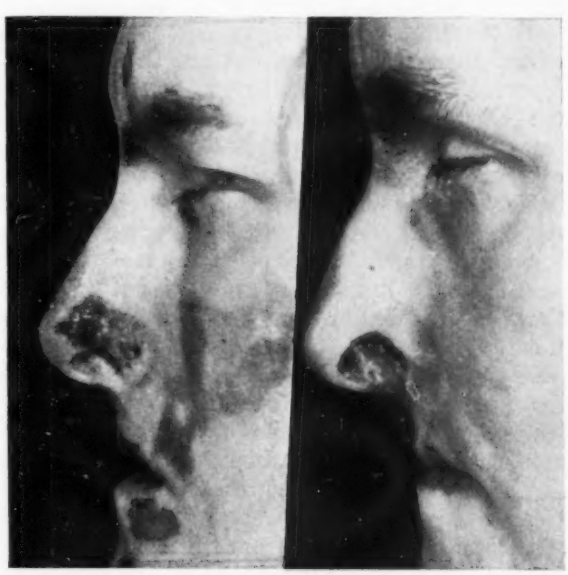
Comment.—In this case the future progress will be important. The patient has been warned that trauma might cause a disfigurement and she has been advised to keep the fissure covered with ointment.

In the case which follows, the last of the series, nasal erosion was observed following the removal of an acoustic neuroma.

Case 8. E.H., aged 40 years, female.

Left acoustic neuroma. Extracapsular removal. Left facial paralysis and anæsthesia. Extensive superficial ulceration of anæsthetic half of face. Progressive recession of left ala nasi.

In May 1941 the patient was operated on by Professor Jefferson and a left-sided acoustic neuroma was removed together with its capsule. The left facial nerve and the trigeminal root were both divided in the course of the operation. Some days after the operation it became necessary to perform a tarsorrhaphy to protect the anæsthetic cornea. The patient failed to attend for examination as she had been asked to do and was next seen seven months after the operation, when she gave the following history. About one month after her discharge from hospital a swelling appeared on the left side of the bridge of the nose. The skin broke and some pus escaped. Next sores developed on the anæsthetic portion of the face and scalp and for five months the ulcers continued to spread and at the same time the anterior half of the left side of the scalp lost a good deal of its hair. At the onset of the condition there had been a purulent discharge from the nose and the patient admitted to having picked off scabs and crusts from the ulcers and from the left nostril. At the time of this examination the ulcers had begun to heal (Fig. 5 A). They were irregular in outline and varied in depths. The deepest



A B

FIG. 5.—Case 8.

A.—The appearance of the patient seven months following section of the fifth root.

B.—The same patient eight months later. Note the increased erosion of the ala nasi.

skin defect was at the side of the nostril where the dermis had become eroded. The floors were covered with dried blood and with encrusted serum. Several small ulcers were present along the lower border of the left lower jaw and were not in the anæsthetic area. The scalp was covered with a layer of oily seborrhoic scales which was thickest in the numb part. The left nasal wing was eroded.

Eight months later the ulcers had completely healed without leaving any scars. The nasal wing had shrunk further (Fig. 5 B) and the epistaxis frequently occurred from the left nostril. The area supplied by the first trigeminal division was still completely anæsthetic, but some sensation had returned to territories of the second and third divisions. In answer to a questionnaire the patient wrote a full " confession " from which the following are quotations: ". . . I am in the habit of picking my nose and rubbing it. My left nostril does not feel to be blocked up, but it has done. . . . I have attempted to remove crusts from my left nostril . . . my nose only bleeds when I either pick it or touch it. . . . I have kept the ulcerated area covered with ointment but I do not do so now. . . ." The ulcerated area to which the patient refers in this letter was on the lower part of the nasal septum and the left side of the philtrum.

Comment.—This is the only case in the series in which the progress of the condition was reviewed after a considerable interval had elapsed. There was evidence of an infection with the Pityrosporon of Molassez and presumably the patient had been subject to seborrhœa before her face became numb, but the infection spread on the anæsthetic skin in a manner which is never equalled in a normally sensitive skin. The importance of the infection in causing the ulcers was peculiar to this case; in others similar but less severe ulceration occurred without evidence of Pityrosporon infection. The ulcers in the sensitive skin on the left side were smaller and quite superficial.

Discussion

To the author's knowledge progressive destruction of the anæsthetic ala nasi has not been previously reported. Rowbotham (1939) in a careful study of the effects of trigeminal denervation made no mention of this condition. Harris (1940) in an analysis of his large material briefly described superficial skin ulcers, but neither he nor Härtel (1938) recorded nasal erosion following Gasserian alcohol injection. Harris had seen " sores around the ala nasi, especially just inside the nostril, but also sometimes on the cheek or forehead " and he drew attention to the fact that " the nasal ulceration may produce small hæmorrhages." In the present paper the emphasis has been laid on a combination of features of which nasal erosion and epistaxis were most constantly present, while skin ulcers and nasal fissure occurred in the majority of the cases.

With the exception of Case 8 all patients in this series had been sufferers from trigeminal neuralgia. Alcohol injection of the ganglion was performed five times and only in two patients was the fifth root sectioned. The injections were preferred to operation variously because of the patient's age, cardiovascular abnormalities or unwillingness to undergo operation. The injection which was followed by erosion of the nostril has in all five cases resulted in an anæsthesia which up to the present has not receded. In Case 4 the ganglion was injected six times in four years but the last injection was performed seven years ago. Up to the present the area supplied by the first division has remained densely anæsthetic and the trophic lesion is situated in this area. In Case 1 total anæsthesia persisted for ten years until the patient's death, in Case 4 it has lasted for four years and in Case 6 for three years. These periods are already considerably longer than the average after an alcohol injection. About 1½ years is generally considered an average duration of anæsthesia after ganglionic injection (Harris (1940), Grant (1936) and the experience in this department is somewhat similar, although many permanent numbnesses have been obtained. It appears that the anæsthesia which is accompanied by nasal erosion is virtually permanent and it may well be that this combination is not fortuitous. Failure of return of sensation may mean that the ganglion cells themselves were irreparably damaged owing to the position of the needle at the time of the injection. It is, however, difficult to conceive of a comparable factor bringing about the lesions in the three cases in which the fifth root was sectioned.

Neuroparalytic keratitis was a feature in five of the eight cases, and preceded the onset of the skin lesions. It is known that the danger of keratitis is greatest in the first week or ten days after trigeminal denervation and that its incidence sharply declines after that date although rarely it may appear after a much longer interval. The immediate post-operative period is further characterized by the frequent occurrence of herpes vesicles in the anæsthetic skin and by a persistence of conjunctival hyperæmia. Erosion of the nasal wing and skin ulcers belong to a later post-operative period. Lewis (1927) produced evidence that irritation of sensory nerves caused the antidromic release of a vasodilator substance—H-substance—in the skin and he suggested that Herpes and herpetiform eruptions were due to an accumulation of this substance. Duke-Elder (1932) regarded Lewis's explanation as providing the most satisfactory theory concerning the evolution of neuroparalytic keratitis. Trophic lesions produced by the accumulation of H-substance presuppose the persistence of functioning nerve fibres capable of conducting antidromic impulses and should be characterized by vasodilatation. When, however, the sensory nerve paths have degenerated, the skin arterioles no longer dilate in response to local stimulation and the " flare " cannot be evoked. It has already been mentioned that hardly any inflammatory reaction occurred either around the skin ulcers or in the skin adjacent to the erosion of the nasal wing, and it is now suggested that these late trophic lesions occur when, owing to degeneration of the nerve-paths, the vascular manifestations of inflammation do not take place in response to local stimulation. On the other hand, the early trophic lesions—herpes and keratitis—are accompanied by a well-marked inflammatory response and may be due to disordered antidromic impulses releasing

excessive quantities of H-substance thus " allowing minor traumata to have gross effects and facilitating the access of organism " (Duke-Elder).

The localization of the skin erosion needs a word of comment. The nose is normally exposed to slight but repeated trauma and with the other acra of the body is most affected by a fall in external temperature. The ala nasi possesses two skin surfaces which radiate heat and are separated by only a thin layer of cartilage dependent on the skin vessels for its nutrition. These factors explain why the nasal wing should be particularly susceptible to trophic lesions or to destructive lesions from other causes. A study of serial sections through the external nose of a full term fœtus revealed no peculiarity of the blood supply relevant to the present discussion.

The treatment of the condition has been influenced by the theoretical conception of its causation. The patients were warned not to touch their noses and to keep ulcers and fissures covered with a bland ointment. The onset of the condition might be prevented if these instructions were presented to all patients who have had an alcohol injection of the ganglion or have undergone a root section.

Summary

1. A new syndrome which followed trigeminal denervation in eight cases is described.

2. The most striking feature in seven of the cases was erosion of the anæsthetic nasal wing.

3. Self-inflicted trauma, usually in response to paræsthesiæ, played an important part in the production of the lesion.

4. It is suggested that failure of the cutaneous vasodilator reflex determines the progression of the lesion.

My thanks are due to Professor Geoffrey Jefferson for his permission to publish these cases and for his help in the preparation of this paper.

References

Duke-Elder, W. S. (1932). *Text-Book of Ophthalmology*, Vol. I. H. Kimpton, London.
Grant, F. C. (1936). *J. Amer. med. Ass.*, **107**, 771.
Harris, Wilfred (1940). *Brain*, **63**, 209.
Härtel, F. (1938). *Dtsch. med. Wchschr.*, **64**, 809.
Lewis, Thomas (1927). *The Blood Vessels of the Human Skin and their Responses*. Shaw and Sons, London.
Rowbotham, G. F. (1939). *Brain*, **62**, 364.

VENTRICULAR CHANGES AFTER CLOSED HEAD INJURY

BY

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Introduction

ALTHOUGH the majority of patients who sustain a closed head injury appear to make a complete and satisfactory recovery, some are left with residual disabilities, which interfere with their well-being and their adjustment to society. It is known that in such cases permanent structural changes often occur in the brain, but clinically it is difficult to ascertain their severity and extent. There is no single method of investigation which affords this information. Such methods as neurological examination, radiological investigation of the skull, psychological tests, and electro-encephalography, each contribute something to the analysis, but each has its limitations. The following study was undertaken in order to evaluate air encephalography, not so much as a method of demonstrating the presence of post-traumatic space-occupying lesions, but of assessing the degree of damage which has occurred in the brain.

That changes in the outline of the ventricles often follow closed head injury was clearly established in papers from Foerster's clinic at Breslau by Schwab (1926*a* and *b*) and by Bielschowsky (1928). Both authors employed encephalography with air introduced by the lumbar route and both described three groups of cases with abnormal encephalographic findings, viz. (*a*) cases in which the ventricles did not fill; (*b*) cases with enlargement and deformity of the ventricles; and (*c*) cases with abnormalities of distribution of the sub-arachnoid air over the cerebral convexities. In addition both studied the circulation of the cerebro-spinal fluid after head injury by injecting sodium iodide solution into the ventricles or lumbar theca, and subsequently ascertaining the time of its appearance in other parts of the cerebro-spinal fluid system or in the urine. On comparing their findings with standards obtained from control cases, both of them concluded that in the majority of cases with abnormal encephalograms there were disturbances of the cerebro-spinal fluid circulation, either in the form of obstruction to the cerebro-spinal fluid pathways or of delayed absorption of the fluid into the bood stream. Bielschowsky, whose paper was based on 106 cases of head injury, of both closed and open types, went further than Schwab and tried to correlate the clinical features of his cases with the encephalographic appearances. He showed that, while in many cases there was an obvious relationship between the two, in other cases this relationship was not apparent; and indeed the same encephalographic appearances as were seen in some cases with persistent symptoms and signs would also be seen in others without persistent symptoms or with only a history of post-traumatic epilepsy.

Since then several other authors have confirmed that encephalographic changes often follow head injury, but without exception they have based their findings on smaller groups of cases and have not extended the scope of Bielschowsky's observations. Fischer (1927), after investigating a series of 14 psychopathic patients, many of whom had sustained head injury several years previously, concluded that similar encephalographic abnormalities could sometimes be found in psychopathic patients who had no history of head injury, and that the correlation between clinical features and encephalographic findings was not always apparent. Swift (1931), Hauptmann (1932), Friedman (1932) and others have regarded encephalography as a means of differentiating between cases with genuine disabilities and cases with functional disturbances, implying that those cases which have normal encephalographic appearances usually belong to the latter group. Several others (Flugel 1932, Bennett and Hunt 1933, Lippens and Desjardin 1934, Travers 1937, Money and Susman 1932), have reported on the encephalographic changes following head injury without offering much comment on their ætiological and clinical significance.

There has thus been little advance in our appreciation of the encephalographic changes following head injury since Bielschowsky's paper appeared in 1928. During the intervening years knowledge of the clinical aspects of head injury has much improved. In this paper an attempt is therefore made to reassess, in terms of present-day clinical standards, the value of air encephalography in the investigation of cases of head injury after the acute stage.

Case Material

Our study is based upon 100 cases of closed head injury, which were admitted to a military hospital for head injuries, either as acute cases or for the investigation of symptoms deemed to be the result of injury. In all of these cases it was considered clinically that the symptoms did, in fact, result from the head injury. Cases with symptoms judged to be

psychoneurotic in origin, or with symptoms considered to be referable to a previous mental or physical defect, were excluded. The series includes cases with depressed fractures, but not those with penetrating injuries. Together they form an unselected consecutive series of cases in which the full hospital notes and X-ray films were available and in which the encephalograms were satisfactory.

Technique

The cisternal route of injection was employed in all except 7 cases. The cerebro-spinal fluid was replaced fractionally with air, and the technique was directed to obtaining an adequate ventricular filling, but not a complete drainage of cerebro-spinal fluid, and thus a full outline of the sub-arachnoid spaces. The amount of air injected was usually between 30 and 60 c.c. This method was generally found adequate to demonstrate the ventricular changes without causing much discomfort to the patient, and without the necessity for employing a general anæsthetic. Its relative simplicity allowed of repeated examination in some cases.

Radiological examination with the six standard Lysholm (1935) projections was carried out, producing a composite picture of the entire ventricular system. The anode-film distance was kept constant at 36 inches; the X-ray film was placed below the skull, and a fixed Lysholm grid was used in order to keep the head-film distance as low as possible and so reduce the amount of distortion, which would have resulted from the use of a Potter-Bucky diaphragm. Thus the radiological technique was standardized to permit of comparative measurements of the ventricles. It did not, however, permit of detailed studies of the distribution of air in the cortical sub-arachnoid spaces, such as would have been possible with lumbar encephalography and full drainage.

Methods of Measurement

Methods of measuring the ventricular system after encephalography have been described by Abramovitch and Winkler (1930), Davidoff and Dyke (1937), and Evans (1942). Abramovitch and Winkler recorded the ventricular measurements with a measuring stereoscope and related the ventricular to the cranial dimensions. Davidoff and Dyke took as their standards the maximum breadth and the length of the ventricular system in 150 cases considered to be normal. Evans compared in children the total breadth of the ventricular system with the maximum breadth of the skull. All these authors directed their measurements of the ventricles to the problem of establishing whether or not hydrocephalus was present.

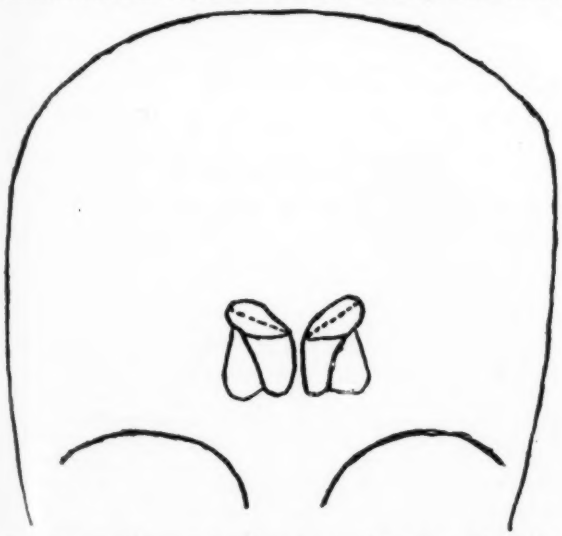

FIG. 1.—Outline of the lateral ventricles as projected in the brow-up antero-posterior view. The dotted line indicates the measurement taken for the assessment of ventricular size.

Our problem was to assess not only general changes in one or both lateral ventricles but also focal changes. The latter occur most frequently in the frontal and temporal horns or in the trigone. From a study of our material it became apparent that the diagonal width of the body of the lateral ventricle formed an arbitrary but reliable criterion of the size of the lateral ventricle as a whole (Fig. 1). This measurement, which is most easily made in the standard brow-up projection, enables the size of the two lateral ventricles to be compared on the same film. Any variations due to inequality in filling of the two ventricles can be excluded by examination of the lateral projection with the brow up, in which view the amount of air in each lateral ventricle can be verified. Focal dilatation can be assessed by comparing component parts of the lateral ventricles with each other. This method of measurement was found to be reliable. In several cases repeated examination showed no change in the measurements obtained, thereby checking their accuracy, and also proving that repeated encephalography does not of itself lead to permanent ventricular changes.

As it had been suggested that variations in intracranial pressure, consequent upon the fractional replacement of cerebrospinal fluid, might cause temporary ventricular distension and so affect the measurements, some experiments were undertaken both on the cadaver and the living subject.

In recently dead cadavers injection of air directly into the ventricles under pressure was found to produce no change in the measurements of more than 1 mm. In four cases, where encephalography was well tolerated, the quantity of air injected was deliberately increased relative to the quantity of fluid withdrawn. In a typical case films were obtained after the injection of 30 c.c. of air with equivalent withdrawal of fluid. A further 25 c.c. of air was then injected, at which point the patient complained of increasing severity of headache. A film was immediately obtained and cerebro-spinal fluid withdrawn to balance the replacement. No increase in the ventricular measurements was observed (Fig. 2), either immediately or during the subsequent radiological procedure, extending over a period of nearly one hour. No alteration in measurements was noted in the other three cases similarly investigated (Table I). It is, therefore, suggested that the possibility of unreliable ventricular measurements, due to pressure changes arising during the injection of air, may be ignored.

TABLE I.—VENTRICULAR MEASUREMENTS IN CONTROL CASES AFTER INTRODUCTION OF ADDITIONAL AIR

	Air injected with equivalent C.S.F. withdrawal (c.c.)	R.L.V. (cm.)	L.L.V. (cm.)	Air injected without further C.S.F. withdrawal (c.c.)	R.L.V. (cm.)	L.L.V. (cm.)
Case 1 ..	20	1·8	1·8	10	1·8	1·8
Case 2 ..	30	1·7	1·8	25	1·7	1·8
Case 3 ..	40	1·9	1·8	25	1·9	1·9
Case 4 ..	35	1·8	1·7	20	1·8	1·7

Controls

In order to establish standards for the normal ventricular measurements, we took a series of 50 cases (Table II), in which encephalography was considered desirable to exclude the presence of a space-occupying lesion, or which were not thought clinically to be examples of diseases usually associated with ventricular enlargement. In all of them the ventricular measurements were made under the same radiographic conditions as those in the head injury series, and in all of them the outlines

A B

FIG. 2.—Table I. Case 3. A. Outline of ventricles after injection of 40 c.c. of air with equivalent withdrawal of c.s.f. B. Outline after the further injection of 25 c.c. of air without any withdrawal of c.s.f.

TABLE II.—CONTROL SERIES

Hospital case no.	Clinical diagnosis	Ventricular measurements R.L.V. (cm.)	L.L.V. (cm.)
722	Idiopathic epilepsy	1·5	1·5
881	Idiopathic epilepsy	1·6	1·6
1498	Idiopathic epilepsy	1·6	1·6
1775	Idiopathic epilepsy	1·6	1·6
*4209	Idiopathic encephalopathy	1·6	1·6
1332	Migraine	1·6	1·6
401	Psychoneurosis	1·6	1·6
938	Familial optic atrophy	1·6	1·7
1396	Idiopathic epilepsy	1·6	1·8
531	Idiopathic epilepsy	1·7	1·6
3305	Idiopathic epilepsy	1·7	1·7
1251	Migraine	1·7	1·7
905	Idiopathic epilepsy	1·7	1·8
3459	Idiopathic epilepsy	1·7	1·8
1167	Disseminated sclerosis	1·8	1·7
4853	Migraine	1·8	1·7
1086	Concomitant squint	1·8	1·7
1461	Idiopathic epilepsy	1·8	1·8
3089	Idiopathic epilepsy	1·8	1·8
2851	Migraine	1·8	1·8
2802	Migraine	1·8	1·8
1406	Psychoneurosis	1·8	1·8
2362	Psychoneurosis	1·8	1·8
979	Retrobulbar neuritis	1·8	1·8
*1946	Idiopathic epilepsy	1·8	1·9
2365	Idiopathic epilepsy	1·8	1·9
2696	Idiopathic epilepsy	1·8	1·9
973	Psychoneurosis	1·8	1·9
3384	Psychopathic personality	1·8	1·9
2717	Disseminated sclerosis	1·8	1·9
*1950	Idiopathic epilepsy	1·9	1·8
*1176	Psychoneurosis	1·9	1·9
*2731	Psychoneurosis	1·9	1·9
706	Vaso-vagal attacks	1·9	1·9
3615	Idiopathic epilepsy	1·9	1·9
4178	Idiopathic epilepsy	1·9	2·0
2431	Idiopathic epilepsy	1·8	2·0
*1288	Psychoneurosis	1·8	2·0
*2916	Psychoneurosis	1·8	2·0
2719	Idiopathic epilepsy	2·0	1·8
2287	Idiopathic epilepsy	2·0	1·9
*1501	Psychoneurosis	2·0	1·9
1506	Idiopathic epilepsy	2·0	2·0
940	Idiopathic epilepsy	2·0	2·0
2612	Idiopathic epilepsy	2·0	2·0
*908	Psychoneurosis	2·0	2·0
2994	Psychoneurosis	2·0	2·0
3144	Psychoneurosis	2·0	2·0
2028	Idiopathic epilepsy	2·1	2·1
2885	Idiopathic epilepsy	2·2	2·2

* Denotes the incidence of a trivial head injury.

of the two lateral ventricles were similar, except for the normal anatomical variations in the development of the occipital horns.

It will be observed that in no case was there a difference of more than 2 mm. between the measurements of the two ventricular bodies and that in as many as 28 cases the ventricular measurements were equal on the two sides. It was therefore considered justifiable to assume that, in the absence of gross cranial asymmetry, a variation in measurement between the two ventricular bodies of more than 2 mm. was significant. The upper limit of normality can only be fixed arbitrarily, but, as in only 2 out of the 50 cases was the oblique diameter of the body of the ventricle greater than 2 cm., figures greater than this were taken to indicate dilatation.

Measurement of the Third Ventricle

The maximum breadth of the third ventricle, as seen in the antero-posterior brow-up projection, was measured in every case. Considerable variation was found to occur in both the head injury and in the control series. There did not appear to us to be any trend towards increased measurement in cases with ventricular dilation. It was therefore decided to regard the breadth of the third ventricle as having too wide a normal range of variation to afford any significant information. This accords with a similar conclusion reached by Fischer (1927).

Analysis of Case Material

General

On the basis of the above standards of normality we found evidence of enlargement of the lateral

ventricles in 69 out of the 100 cases, as opposed to 2 out of 50 cases in the control series. In some cases the enlargement involved only a part of the lateral ventricle (*focal dilatations*), whereas in others the whole of the lateral ventricle was affected (*generalized dilatations*). As this suggested that the ventricular dilatations might have been produced by more than one mechanism, we arranged our 100 cases into the following four radiological groups according to the type and extent of the ventricular changes:

(1) Those without dilatation of the ventricles. Table III. (*Normal encephalograms*) 31 cases

(2) Those with focal dilatation of part of the ventricular system. Table IV. (*Focal dilatation*) .. .. 15 cases

(3) Those with generalized *dilatations* of the lateral ventricles:
  (*a*) Of one ventricle only. Table V. (*Unilateral generalized dilatation*).. .. .. .. 21 „
  (*b*) Of both ventricles. Table VI. (*Bilateral generalized dilatation*).. .. .. .. 26 „

(4) Those with focal dilatations superimposed on generalized dilatations. Table VII. (*Focal with generalized dilatation*) .. 7 „

TABLE III.—NORMAL ENCEPHALOGRAMS

No.	Diagnosis	P.T.A.	R.L.V. (cm.)	L.L.V. (cm.)	Site	Fractures
1	Head injury. Not unconscious. Post-traumatic syndrome.	Nil	1·8	1·7	Frontal	Nil
2	Head injury. Not unconscious. Post-traumatic epilepsy.	Nil	1·9	1·9	Left temporal	Nil
3	Head injury. Not unconscious. Post-traumatic syndrome.	Nil	1·6	1·7	Frontal	Compound frontal
4	Head injury. Not unconscious. Post-traumatic syndrome.	Nil	1·7	1·8	Occipital	Nil
5	Post-traumatic epilepsy	Minutes	1·8	1·9	Left side	Nil
6	Head injury with residual pyramidal signs.	Minutes	1·8	1·9	Right parietal	Nil
7	Post-traumatic epilepsy	Minutes	1·9	2·0	Not known	Nil
8	Head injury without residual sequelæ.	2 hours	1·7	1·9	Right frontal	Nil
9	Head injury with residual pyramidal signs.	2½ hours	1·7	1·7	Vertex	Slightly depressed vertex
10	Post-traumatic syndrome	3 hours	*	*	Right frontal	Nil
11	Post-traumatic syndrome	12 hours	1·8	1·8	Right frontal	Compound depressed
12	Post-traumatic syndrome	12 hours	1·9	1·8	Not known	Nil
13	Head injury with cranial nerve palsy	18 hours	1·9	1·9	Frontal	Slightly depressed frontal
14	Post-traumatic epilepsy	1 day	1·7	1·9	Not known	Nil
15	Post-traumatic syndrome	1½ days	1·9	1·9	Right parietal	Depressed right parietal
16	Post-traumatic syndrome	2 days	1·6	1·7	Right frontal	Nil
17	Post-traumatic syndrome	2 days	1·6	1·6	Occipital	Nil
18	Head injury with cranial nerve palsy. Post-traumatic syndrome. ..	2 days	1·9	1·9	Left frontal and Right occipital	Nil Nil
19	Head injury with cranial nerve palsy	3 days	1·7	1·7	Right temporal	Comminuted
20	Head injury with cranial nerve palsy	3 days	1·6	1·6	Mid-frontal	frontal
21	Post-traumatic epilepsy	4 days	1·7	1·6	Left occipital	Left posterior parietal
22	Head injury with hypothalamic and brain stem signs. Post-traumatic intellectual deterioration.	5 days	1·6 1·7 1·6	1·6 1·7 1·6	Not known	Nil
23	Post-traumatic syndrome	5 days	1·6	1·6	Left frontal	Left frontal
24	Head injury with cranial nerve palsy	5 days	1·6	1·6	Right frontal	Comminuted frontal
25	Post-traumatic syndrome. Optic radiation distrubance.	1½ weeks	2·0	2·0	Left occipital	Depressed left occipital
26	Post-traumatic syndrome	1½ weeks	1·8	1·9	Not known	Nil
27	Post-traumatic intellectual deterioration.	2½ weeks	1·6	1·6	Left temporal	Left temporal
28	Head injury with brain stem signs ..	3 weeks	1·9	1·9	Not known	Nil
29	Post-traumatic intellectual deterioration.	3 weeks	1·8	1·8	? Occipital	Nil
30	Head injury with brain stem signs ..	4 weeks 3 weeks	1·8	1·8	? Occipital	Nil
31	Head injury with cranial nerve palsy. Post-traumatic syndrome.	1½ months	1·6	1·7	Left side	Multiple left parietal

* Air was present in the cavum septi pellucidi, separating and angulating the ventricular bodies, which were, however, of normal size and outline. It was felt that the standard measurements were not applicable in such a case.

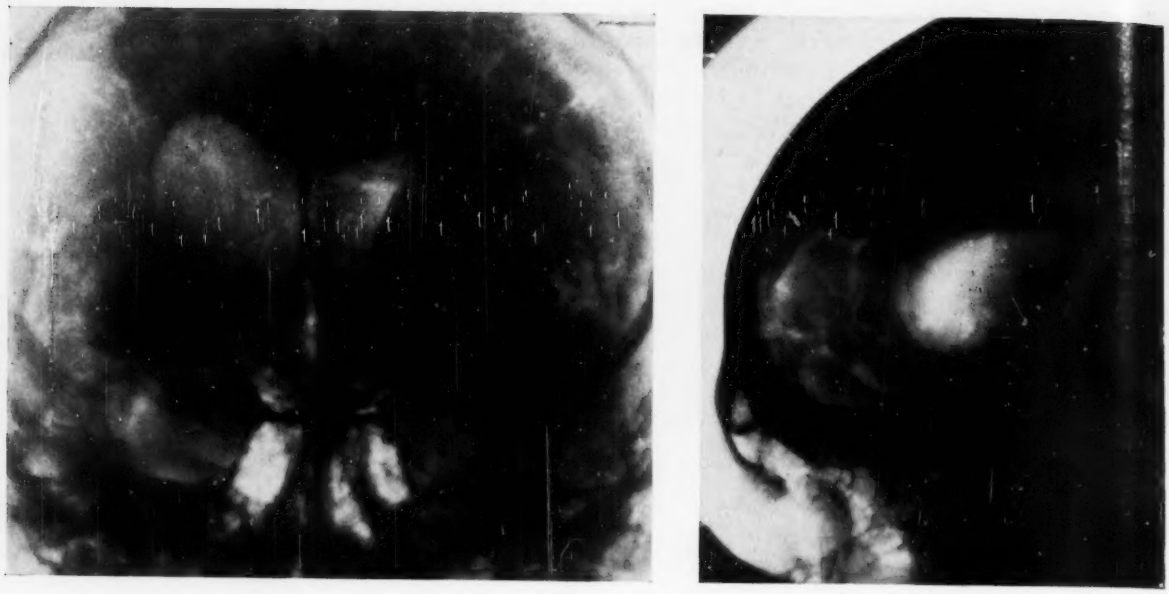

FIG. 3.—Focal dilatation. Case No. 35. Focal dilatation of the anterior horn of the right lateral ventricle.

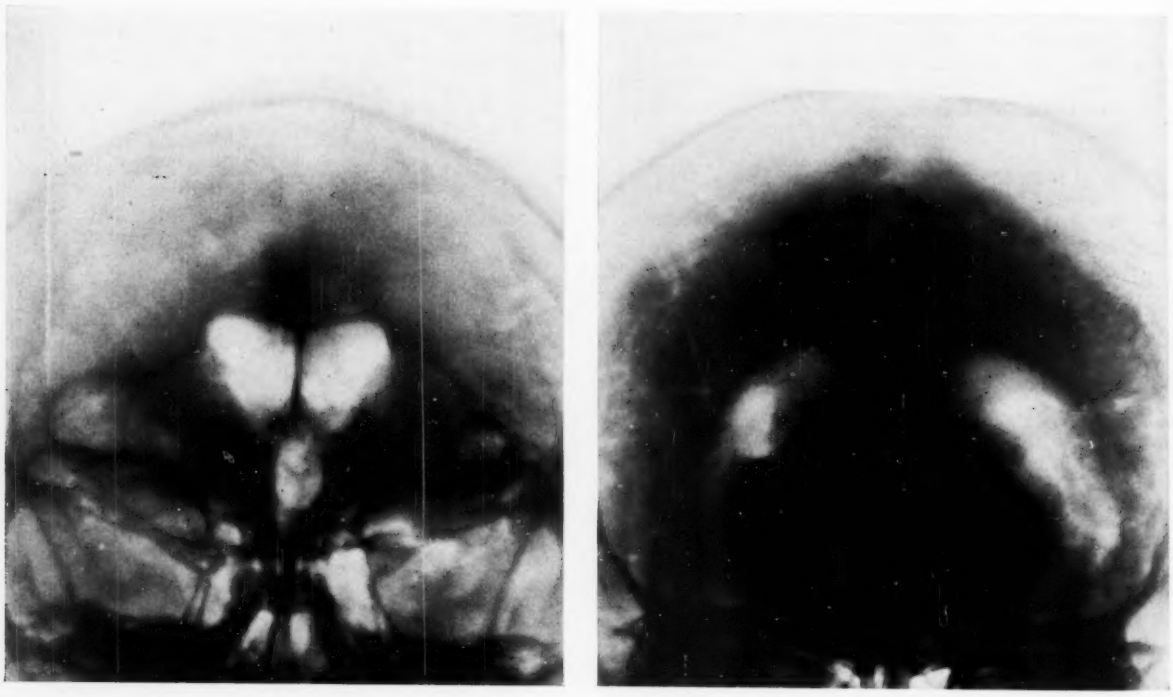

FIG. 4.—Focal dilatation. Case No. 43. Focal dilatation of the trigone of the left lateral ventricle.

These figures establish that ventricular dilatation supervenes in a high proportion of cases after head injury. Our series, however, constitutes a highly selected group of cases in that, with one exception, they all showed either some residual complication due to the head injury or else some unusual feature during the acute stage, such as prolonged post-traumatic confusion or epileptic attacks, which necessitated detailed investigation (see later). This exception, Case 8, was our only example of the common straightforward type of head injury with short duration of unconsciousness and subsequent rapid and complete recovery, and had a normal encephalogram. Consequently our observations are based almost entirely on the more complicated cases which are more likely to show abnormalities. We have evidence, however, to suggest that ventricular dilatation seldom supervenes after trivial injuries, whereas it occurs much more frequently after severe head injuries.

In order to elucidate the factors responsible for the enlargement of the ventricles, we attempted to correlate the type and extent of the ventricular dilatation with the severity of the head injury as

judged by clinical standards, with the site of injury, and with the time after injury when the dilatation became apparent.

It is often difficult to measure clinically the severity of brain damage resulting from injury, as sometimes even severe destruction of brain tissue may occur without much upset to the patient. Two criteria, which are often used clinically for assessing the severity of head injuries, are the duration of the post-traumatic amnesia and the amount of blood in the cerebro-spinal fluid in the acute phase of the injury. Neither of these criteria is entirely reliable, because sometimes the brain may be seriously damaged without loss of consciousness resulting, or without the appearance of blood in the cerebro-spinal fluid. Of these two criteria the duration of the post-traumatic amnesia is the more easily obtained and was estimated in each of our cases. In Table VIII the frequency and the degree of the ventricular dilatation in our cases is analysed with regard to the length of the post-traumatic amnesia. The table shows that the frequency of ventricular dilatation rises steadily with increasing duration of the post-traumatic amnesia, from 33 per cent. in cases where there was no post-traumatic amnesia to 92 per cent. in cases where the post-traumatic amnesia extended longer than a month. Moreover the extent to which the ventricles dilated also seemed to increase with the duration of the post-traumatic amnesia. Thus out of 18 cases in which the post-traumatic amnesia was under 1 day, 2 (11 per cent.) had focal dilatation and 3 cases (17 per cent.) had generalized bilateral dilatation: out of 13 cases in which the post-traumatic amnesia ex-

TABLE IV.—FOCAL DILATATIONS

No.	Diagnosis	P.T.A.	R.L.V. (cm.)	L.L.V. (cm.)	Local changes	Site	Fractures
32	Head injury with cranial nerve palsies.	12 hours	1·8	1·9	Dilatation left anterior horn	Frontal	Left frontal
33	Head injury without residual sequelæ.	1 day	1·6	1·6	Dilatation left anterior horn	Left frontal	Left frontal
34	Head injury with residual pyramidal signs. Post-traumatic intellectual deterioration.	4 days	1·8	1·8	Dilatation right temporal horn and vestibule	Right side	Depressed right temporal
35	Post-traumatic epilepsy ..	4 days	2·4	2·4*	Gross dilatation right anterior horn and both anterior bodies	Right frontal	Right frontal compound comminuted
36	Post - traumatic syndrome. Post-traumatic epilepsy.	1 week	1·8	1·8	Both anterior horns dilated; right more than left	Frontal	Depressed frontal
37	Post-traumatic syndrome ..	1 week	1·8	1·8	Dilated right vestibule	Not known	Diastasis right lambdoid
38	Post - traumatic syndrome. Head injury with cranial nerve palsies	1½ weeks	2·0	1·7	Dilated right anterior horn	Right frontal	Right frontal
39	Post-traumatic intellectual deterioration.	1½ weeks	1·8	1·8	Dilated right anterior horn	Right frontal	Right frontal
40	Head injury with residual pyramidal signs. Post-traumatic epilepsy.	2½ weeks	1·8 1·8	2·0 2·0	Dilated left anterior horn and right vestibule	Multiple	Right occipital
41	Head injury with residual brain stem signs.	2–3 weeks	1·9 2·0	2·4 2·4	Dilatation left anterior body and anterior horn	Left vertex	Nil
42	Head injury with residual pyramidal signs.	3–4 weeks	1·9	1·8	Slight dilatation left vestibule	Right temporal	Nil
43	Head injury with residual pyramidal signs. Post-traumatic intellectual deterioration.	1 month	1·8	1·8	Slight dilatation left vestibule and temporal horn	Right parietal	Right sided
44	Head injury with residual pyramidal signs.	1 month	1·6	2·0	Dilatation left anterior body and anterior horn	Left frontal	Nil
45	Head injury with residual pyramidal signs. Dysphasia. Post - traumatic intellectual deterioration.	1½ months	1·8	2·1	Dilatation left anterior body and anterior horn	Left side	Left parietal
46	Post-traumatic intellectual deterioration.	2 months	1·7	1·7	Dilatation both anterior horns	Left parietal	Nil

* The dilatation in this case was essentially focal despite the bilateral enlargement.

TABLE V.—GENERALIZED DILATATIONS—UNILATERAL

No.	Diagnosis	P.T.A.	R.L.V. (cm.)	L.L.V. (cm.)	Site	Fractures
47	Post-traumatic epilepsy	Nil	1·9	2·5	Occipital	Nil
48	Post-traumatic syndrome	Minutes	1·9	2·3	Right parietal	Nil
49	Head injury with optic-radiation disturbances.	Minutes	1·9	2·2	Right occipital	Compound right occipital
50	Post-traumatic intellectual deterioration.	4 days 2½ days	1·6	2·3	Left parietal	Nil
51	Head injury with residual pyramidal signs. Post-traumatic syndrome.	3 days	2·3 2·3	1·8 2·0	Not known	Nil
52	Head injury with cranial nerve palsy	3 days	1·8	2·4	Occipital	Nil
53	Post-traumatic intellectual deterioration.	1 week	2·1	1·7	Right frontal	Nil
54	Post-traumatic syndrome	1 week	1·8	2·5	Left frontal	Nil
55	Head injury with residual pyramidal signs.	1½ weeks	2·2	1·8	Right parietal	Right parietal
56	Head injury with residual pyramidal signs and cranial nerve palsies.	2 weeks	2·0	1·8	Right parietal	Right parietal
57	Head injury with residual pyramidal signs. Post-traumatic epilepsy.	2 weeks	2·0	3·0	? Left side	? Left parietal
58	Post-traumatic intellectual deterioration.	2 weeks	2·0	2·3	Not known	Nil
59	Head injury with residual pyramidal signs.	2 weeks	2·0	2·3	Frontal	Basal
60	Head injury with residual pyramidal signs. Post-traumatic epilepsy.	2 weeks	2·0 2·0	1·7 1·7	Right side	Right temporal
61	Head injury without residual sequelæ	3 weeks	1·9	2·5	Right temporal	Right frontal
62	Head injury with residual pyramidal signs.	3 weeks	1·7	2·1	Left temporal	Nil
63	Post-traumatic intellectual deterioration.	3 weeks	1·5	2·0	Left parietal	Left parietal
64	Post-traumatic syndrome. Post-traumatic epilepsy.	3 weeks	1·7	2·0	Right parietal	Nil
65	Head injury without residual sequelæ	3–4 weeks	2·0	2·3	Frontal	Nil
66	Head injury without residual sequelæ	1½ months	1·6	2·0	Not known	Nil
67	Post-traumatic syndrome	3 weeks	1·9	2·1	Not known	Nil

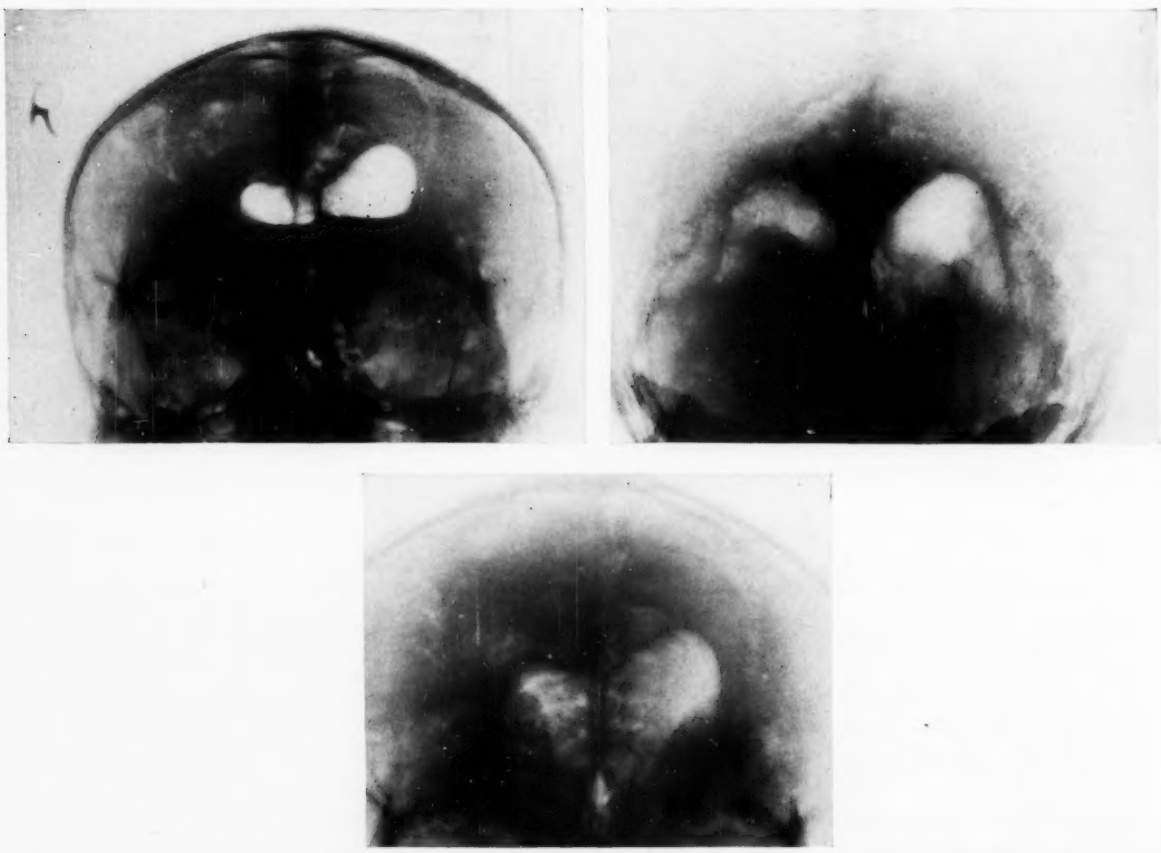

FIG. 5.—Unilateral general dilatation. Case No. 57. General dilatation of the left lateral ventricle without focal changes or enlargement of the right lateral ventricle.

FIG. 6.—Bilateral general dilatation. Case No. 81. Dilatation of both lateral ventricles, the left being somewhat more affected.

TABLE VI.—GENERALIZED DILATATIONS—BILATERAL

No.	Diagnosis	P.T.A.	R.L.V. (cm.)	L.L.V. (cm.)	Site	Fractures
68	Head injury without unconsciousness. Head injury with pyramidal residual signs.	Nil	2·5	2·1	Mid-vertex	Depressed vertical
69	Head injury with residual pyramidal signs.	3 minutes	2·5	2·0	Left side	Diastasis left coronal
70	Post-traumatic syndrome	1 day	2·4	2·1	Right side	Nil
71	Post-traumatic intellectual deterioration.	1 day	2·3	3·2	Right frontal	Nil
72	Post-traumatic intellectual deterioration.	4 days	2·7	2·8	Left frontal	Nil
73	Head injury with cranial nerve palsy. Post-traumatic epilepsy.	4–5 days	2·4	2·5	Right side	Right parietal
74	Post-traumatic epilepsy	1 week	2·4	2·4	Right temporal	Right temporal
75	Head injury with optic radiation disturbance. Post-traumatic epilepsy.	1 week	2·3	2·3	Not known	Left parietal
76	Head injury without residual sequelæ	1½ weeks	2·1 2·3	2·4 2·5	Right parietal	Nil
77	Post-traumatic intellectual deterioration. Post-traumatic epilepsy.	2 weeks	2·4	2·4	Not known	Nil
78	Head injury with cranial nerve palsies. Post-traumatic syndrome.	2 weeks	2·3	2·3	Not known	Right parietal
79	Head injury with residual pyramidal signs. Post-traumatic intellectual deterioration.	2–3 weeks	2·1	2·3	Not known	Nil
80	Post-traumatic intellectual deterioration.	3 weeks	2·5	3·0	Frontal	Left parietal
81	Post-traumatic syndrome	3 weeks	2·6	3·1	Not known	Occipital
82	Head injury with residual pyramidal signs. Dysphasia and cranial nerve palsies. Post-traumatic epilepsy.	3 weeks	2·8	2·8	Not known	Right parietal
83	Head injury with cranial nerve palsies. Post-traumatic syndrome.	4 weeks	2·1	2·6	Occipital ?	Left sided multiple
84	Head injury with residual pyramidal signs.	+1 month	2·0	2·4	Right side ?	Nil
85	Post-traumatic intellectual deterioration.	+1 month	2·2	2·7	Not known	Not known
86	Post-traumatic intellectual deterioration.	+1 month	2·2	2·7	Frontal	Nil
87	Head injury without residual sequelæ	+1 month	2·1	2·3	Right frontal	Right frontal
88	Head injury without residual sequelæ	1½ months	2·8	2·3	Frontal	Nil
89	Head injury without residual sequelæ	1½ months	2·8	3·0	Vertex	Nil
90	Post-traumatic intellectual deterioration.	1½ months	2·5	2·8	Right frontal	Nil
91	Post-traumatic intellectual deterioration.	1½ months	2·1	2·2	Right side	Maxilla
92	Post-traumatic intellectual deterioration.	+1½ months	2·5	2·7	Not known	Nil
93	Head injury with residual pyramidal signs. Post-traumatic intellectual deterioration.	2–3 months	2·8	2·5	Not known	Right parietal

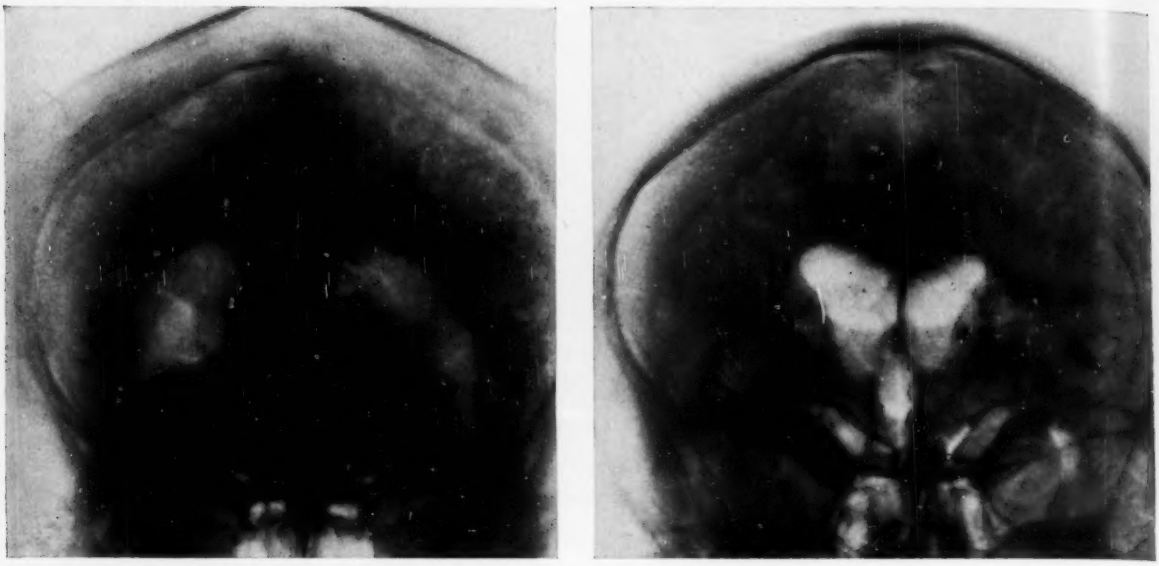

FIG. 7.—Bilateral general dilatation. Case No. 88. Bilateral general dilatation of the lateral ventricles, the right side being more affected than the left but both being enlarged.

TABLE VII.—FOCAL DILATATIONS ASSOCIATED WITH GENERALIZED

No.	Diagnosis	P.T.A.	R.L.V. (cm.)	L.L.V. (cm.)	Local changes	Site	Fractures
94	Post-traumatic syndrome ..	1 day	2·3	2·6	Left more than right throughout but especially left vestibule and posterior horns	Frontal	Basal
95	Head injury with residual pyramidal signs.	4 days	2·0	2·7	Relative dilatation of left frontal and temporal horns	Left frontal	Left frontal
96	Head injury with bilateral 6th nerve palsy.	4 days	2·1	2·3	Left vestibule dilated	Frontal	Frontal
97	Post-traumatic epilepsy ..	5 days	1·7 1·7	2·2 2·2	Left a little+ anteriorly	Frontal	Nil
98	Head injury with residual pyramidal signs.	4 weeks	2·0	1·9	Right vestibule dilated	Not known	Nil
99	Head injury with residual pyramidal signs.	4 weeks	1·8	2·1	Left vestibule dilated	Occipital	Nil
100	Post-traumatic intellectual deterioration.	Not assessable	2·0	2·0	Both anterior horns+	Left frontal	Depressed frontal

TABLE VIII.—DURATION OF THE POST-TRAUMATIC AMNESIA IN THE VARIOUS TYPES OF POST-TRAUMATIC VENTRICULAR DILATATION

Duration of P.T.A.	No. of cases in each time period	No ventricular dilatation	Ventricular dilatation				
			Focal	Generalized		Focal and Generalized	All types
				Unilateral	Bilateral		
		31 cases	15 cases	21 cases	26 cases	7 cases	69 cases
No P.T.A. ..	6	4 (67 per cent. of group)	0	1	1	0	2 (33 per cent. of group)
Under 1 day	18	10 (56 ,, ,,)	2	2	3	1	8 (44 ,, ,,)
1–7 days ..	26	10 (38 ,, ,,)	4	5	4	3	16 (62 ,, ,,)
1–4 weeks ..	37	6 (16 ,, ,,)	7	11	11	2	31 (84 ,, ,,)
Over 1 month	13	1 (8 ,, ,,)	2	2	7	1	12 (92 ,, ,,)

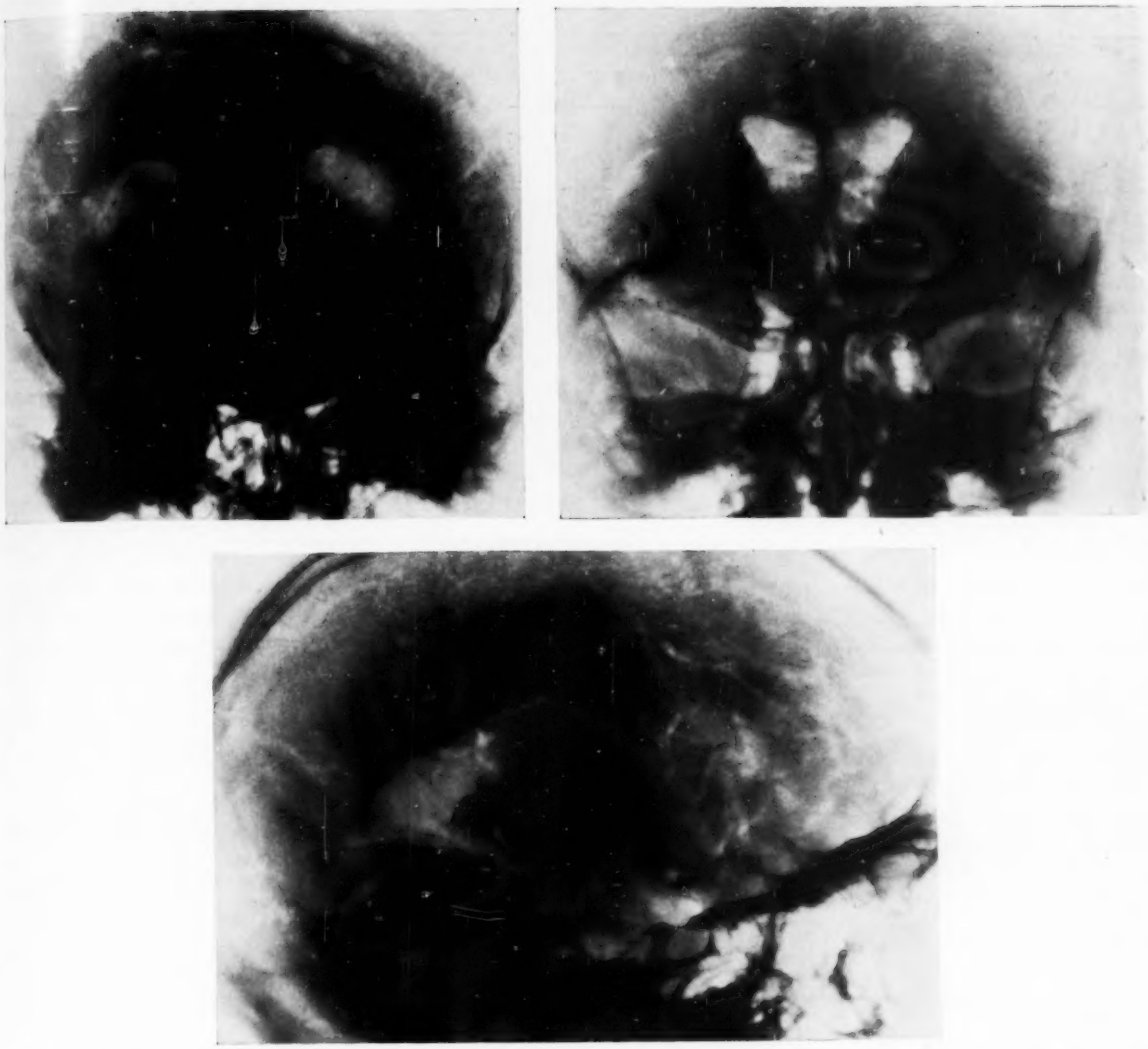

FIG. 8.—Focal dilatation associated with generalized. Case No. 99. An example of general dilatation of the left lateral ventricle with a superimposed focal dilatation of the trigone. The right lateral ventricle is unaffected.

tended longer than a month 2 cases (15 per cent.) had focal dilatation and 7 (54 per cent.) had generalized bilateral dilatation.

Records of the findings on lumbar puncture performed during the first week after injury were available in only 17 cases. In 2 of these the cerebro-spinal fluid was normal, whereas in the remaining 15 cases it contained blood. Of the 17 cases, 4, including the two with normal cerebro-spinal fluids, were later shown to have normal ventricular outlines, whereas 13 of those which had had subarachnoid hæmorrhage were later demonstrated to have dilated ventricles. Assuming that blood in the cerebro-spinal fluid is an indication of severe head injury, these observations confirm the impression derived from the analysis of the post-traumatic amnesia standards that the more severe degrees of cerebral trauma are apt to be followed by ventricular dilatation.

An analysis of the ventricular changes in relation to the sites at which the violence had been applied did not indicate any causal connexion between the two (Table IX). If, for the moment, fractures of the skull are not taken into account, it would appear from Table IX that both focal dilatations and unilateral or bilateral dilatations of the ventricles are caused just as frequently by injuries delivered in the antero-posterior axis of the skull as they are by injuries delivered from the side. One reason which may account for this apparent lack of correlation between the site of injury and the site and extent of the subsequent ventricular dilatation is that in road accidents, which formed a large proportion of our cases, the skull is often subjected to multiple blows, as Cairns (1941) has shown from a study of the crash helmets of injured motor-cyclists. In 9 cases the dilatation appeared to have been caused by contre-coup; three of these had received occipital injuries, which had resulted in a generalized dilatation of the contralateral ventricle in five cases and focal dilatation in one.

Although the actual site of violence appears to have little connexion with the development of any particular type of ventricular dilatation, the production of a localized fracture of the skull seems to influence the development of a focal dilatation of the ventricle

TABLE IX.—RELATION OF VENTRICULAR CHANGES TO SITES OF INJURY

Encephalographic appearances	No. of cases in each group	Site of injury to skull			
		Frontal and occipital	Lateral	Vertical	Not known
Normal ventricles ..	31	Cases 17 (55 per cent. of group)	Cases 7 (23 per cent. of group)	Cases 1 (3 per cent. of group)	Cases 6 (19 per cent. of group)
Focal dilatation of ventricles..	15	7 (47 per cent. of group)	6 (40 per cent. of group)	1 (7 per cent. of group)	1 (7 per cent. of group)
Generalized dilatation of ventricles	47	15 (32 per cent. of group)	17 (36 per cent. of group)	2 (4 per cent. of group)	13 (28 per cent. of group)
(*a*) Unilateral ..	21	7 (33 per cent. of group)	10 (48 per cent. of group)	—	4 (19 per cent. of group)
(*b*) Bilateral ..	26	8 (31 per cent. of group)	7 (27 per cent. of group)	2 (8 per cent. of group)	9 (35 per cent. of group)
Focal and generalized dilatations of ventricles	7	6 (86 per cent. of group)	1 (14 per cent. of group)	—	—

TABLE X.—RELATION OF VENTRICULAR CHANGES TO FRACTURE OF SKULL.

Encephalographic appearances	No. of cases in each group	Fracture of skull	
		Present	Not present
Normal ventricles	31	Cases 13 (42 per cent. of group)	Cases 18 (58 per cent. of group)
Focal dilatation of ventricles ..	15	11 (73 ,, ,,)	4 (27 ,, ,,)
Generalized dilatation of ventricles	47	21 (45 ,, ,,)	26 (55 ,, ,,)
(*a*) Unilateral	21	8 (38 ,, ,,)	13 (62 ,, ,,)
(*b*) Bilateral	26	13 (50 ,, ,,)	13 (50 ,, ,,)
Focal and generalized dilatation of ventricles	7	4 (57 ,, ,,)	3 (43 ,, ,,)

(Table X). Thus a fracture of the skull was observed in 15 out of 22 cases (68 per cent.) with focal or focal and generalized dilatations of the skulls as opposed to 34 out of 78 cases (44 per cent.) in which the ventricles were normal or only showed a uniform enlargement. In the majority of the cases of focal dilatation of the ventricles associated with fracture, the ventricular enlargement occurred immediately beneath the site of fracture (9 out of 11 cases). In 2 cases, however, the ventricle on the opposite side had dilated, apparently by contre-coup.

As regards the time of onset of post-traumatic ventricular dilatation, we have evidence which suggests that it is usual for dilatation to commence in less than 3 weeks and that it may reach its maximum within 4 weeks. This evidence is, however, scanty, as encephalography was seldom undertaken during the acute phase of head injury, and, moreover, was usually performed only once in each case. Out of the 69 cases which showed ventricular enlargement, only 7 were examined within a month of injury. Of these, 5, which were examined between 3 and 4 weeks after injury (Cases 32, 43, 53, 59, and 63), showed ventricular dilatation. In one of these (Case 43), which was first examined 1 month after injury, and later re-examined 2 months and 3½ months after injury, the dilatation did not appear to have progressed after the first examination. In 2 cases (Cases 40 and 76), which were first examined earlier than 3 weeks after injury, some progression in the ventricular changes was subsequently demonstrated at a later examination. In Case 40 the first encephalogram (2 weeks after injury), was normal but encephalography repeated at 6 weeks and again at 8 weeks showed that a dilatation of the left anterior horn and right ventricle had appeared between the first and second examinations, but had not increased in size after the 6th week. In the second case (Case 76), slight ventricular enlargement, which was present at 2½ weeks, appeared to have increased when examined at 5 weeks. We have no cases in our series in which we found evidence of progression of the ventricular enlargement later than 4–6 weeks after injury.

Correlation with symptoms and physical signs

An analysis of the clinical features of our cases, made in conjunction with the encephalographic findings, shows that the connexion between the degree and type of the ventricular enlargement and the clinical symptoms is not always obvious. In one case, for example, generalized bilateral ventricular dilatation of considerable degree might (Case 93), be associated with marked residual neurological

signs, and in another case (Case 88) with none at all. Again, when one ventricle is dilated more than its fellow, the neurological signs present, contrary to the usual observation, may be referable to the side with the smaller or more normal ventricle, whereas the side of the brain with the greater ventricular dilatation gives rise to no symptoms or signs.

Frequently, however, the enlargement of the ventricles could be correlated with neurological features, such as hemiparesis, aphasia, or visual field disturbances, indicating permanent focal damage to the brain. In Table XI the frequency of ventricular dilatation in cases with persistent neurological signs is compared with that in cases without signs of focal cerebral damage. It shows that about 89 per cent. of the cases with persistent focal signs showed ventricular enlargement, as compared with 62 per cent. of the cases in the second group and with 4 per cent. of cases in the control series.

In order to appraise the clinical significance of post-traumatic ventricular dilatation more fully, we arranged our cases into the following clinical groups and attempted to correlate the clinical features with the encephalographic appearances.

(1) Head injury without unconsciousness .. 6 cases
(2) Head injury without residual sequelæ .. 9 ,,
(3) Head injury with residual neurological signs .. .. 44 ,,
  (*a*) With pyramidal signs 24 cases
  (*b*) With hypothalamic and/or brain stem signs 4 ,,
  (*c*) With optic radiation disturbances .. .. 3 ,,
  (*d*) With cranial nerve palsies .. .. 16 ,,
(4) Post-traumatic syndrome .. .. 29 ,,
(5) Post-traumatic intellectual deterioration 24 ,,
(6) Post-traumatic epilepsy .. .. .. 19 ,,

A total of 131 diagnoses thus was made in the 100 cases, multiple diagnoses being made in 30 cases. In each instance the diagnosis was based on the clinical features prevailing after recovery from the head injury and not on the signs present in the acute stage. The allocation of cases to the first three groups and to the last group was straightforward. The assignment of cases to the groups of post-traumatic syndrome and post-traumatic intellectual deterioration was necessarily more arbitrary; those cases in which chronic headaches, often associated with giddiness and fatigue, were prominent were allocated to the first group, and those in which an objective personality change predominated were assigned to the second group. No case was placed in both groups. No separate group was made for cases showing residual sensory signs or, in cases where the dominant hemisphere was damaged, for residual speech disturbances, because in no instance were such signs observed without motor signs, and consequently these cases are already represented in the group showing residual pyramidal signs.

The frequency with which these clinical states were encountered in relation to the various grades of post-traumatic ventricular dilatation is outlined in Table XII. A more detailed study of each group will be given below, but certain important generalizations may here be stressed. Residual pyramidal signs indicative of hemisphere damage are very frequently associated with dilatation of the ventricle on the opposite side of the brain. Primary hypothalamic and brain stem signs, on the other hand, are usually not associated with ventricular dilatation. Cases of post-traumatic syndrome usually have normal or only slightly dilated ventricles, whereas cases of post-traumatic intellectual deterioration often show most marked ventricular dilatation. In all these groups, therefore, an apparent connexion between clinical features and ventricular changes can be made out. On the other hand, no such relationship is evident in cases presenting cranial nerve palsies or post-traumatic epilepsy. Our findings in the groups of head injury without unconsciousness and head injury without residual sequelæ are not applicable to head injuries in general, as our material in these two groups is too highly selected.

A more detailed analysis of each clinical group will now be considered.

Head Injury without Unconsciousness

There were 6 cases in this group. All had a clear recollection of the accident, and were subsequently investigated between 3 and 15 months later on account of persistent features considered to be due to the injury (post-traumatic syndrome, 3 cases; post-traumatic epilepsy, 2 cases; residual pyramidal signs, 1 case). Four cases showed normal ventricular outlines, and two (Cases 47 and 68) showed some dilatation of the ventricles presumably related to the head injury.

TABLE XI.—FREQUENCY OF VENTRICULAR DILATATION IN THE HEAD INJURY AND CONTROL SERIES

	No. of cases in each group	Cases with normal ventricles	Cases with ventricular dilatation
Total head injuries	100	31 (31 per cent. of group)	69 (69 per cent. of group)
(*a*) Head injury with persistent signs of focal cerebral damage	27	3 (11 ,, ,,)	24 (89 ,, ,,)
(*b*) Head injury without persistent signs of focal cerebral damage	73	28 (38 ,, ,,)	45 (62 ,, ,,)
Control series	50	48 (96 ,, ,,)	2 (4 ,, ,,)

TABLE XII.—FREQUENCY OF THE DIFFERENT CLINICAL STATES IN THE VARIOUS TYPES OF POST-TRAUMATIC VENTRICULAR DILATATION

Diagnostic group	No. of cases in each group	No ventricular dilatation	Ventricular dilatation				
			Focal	Generalized		Focal and Generalized	All types
				Unilateral	Bilateral		
		31 cases	15 cases	21 cases	26 cases	7 cases	69 cases
1. Head injury without unconsciousness ..	6	4 (67 per cent.)	0	1	1	0	2 (33 per cent.)
2. Head injury without residual sequelæ ..	9	1 (11 ,,)	1	3	4	0	8 (89 ,,)
3. Head injury with residual neurological signs..	44	12 (27 ,,)	9	9	10	4	32 (73 ,,)
(*a*) Pyramidal ..	24	2 (8 ,,)	6	7	6	3	22 (92 ,,)
(*b*) Hypothalamic and brain stem ..	4	3 (75 ,,)	1	0	0	0	1 (25 ,,)
(*c*) Optic radiation.. ..	3	1 (35 ,,)	0	1	1	0	2 (65 ,,)
(*d*) Cranial nerve palsies ..	16	6 (27 ,,)	3	2	4	1	10 (73 ,,)
4. Post-traumatic syndrome	29	14 (48 ,,)	3	6	4	2	15 (52 ,,)
5. Post-traumatic intellectual deterioration	24	3 (12 ,,)	5	4	11	1	21 (88 ,,)
6. Post-traumatic epilepsy..	19	6 (32 ,,)	3	4	5	1	13 (68 ,,)
Controls	50	48 (96 ,,)	0	0	2	0	2 (4 ,,)

Case 47.—The first of these two cases with ventricular dilatation was a 22-year-old signaller, who fell 12–15 feet backwards from a telegraph pole, striking his head on soft earth without losing consciousness. Four hours later he had a generalized epileptic convulsion and subsequently he had recurrent attacks at intervals of 2 or 3 months. There were no abnormal neurological signs and no previous personal or family history of epilepsy. The electroencephalogram revealed slow high-voltage waves over both hemispheres, suggestive of idiopathic epilepsy, but because symptoms had first occurred so early after the injury the case was considered clinically to be one of post-traumatic epilepsy. Air encephalography demonstrated moderate dilatation of the left lateral ventricle.

Case 68.—The second case was a 39-year-old aircraftsman who received a blow over the vertex when a building collapsed after an explosion. He sustained a small compound depressed fracture over the centre of the superior longitudinal sinus but did not lose consciousness. Immediately after injury he developed slight weakness and numbness of both lower limbs, more marked on the left side than on the right, without disturbance of micturition or defaecation. At operation the depressed fragments were elevated and the dura shown to be intact. Subsequently this patient was left with slight residual spasticity in both lower limbs, again more in the left than the right. Encephalography showed bilateral general ventricular dilatation which was moderate on the right side and slight on the left.

These two cases indicate that ventricular dilatation can develop after head injuries in which consciousness was not lost. The responsible mechanism is not known. Possibly a thrombosis of the superior longitudinal sinus, directly resulting from the injury, may have played a part in the second case, but such a mechanism was unlikely in the first case.

Head Injury without Residual Sequelæ

Nine cases in the series eventually made complete clinical recoveries. In only one was the ventricular system normal. This case (Case 8) was the only example of a comparatively mild and straightforward head injury in our series. There was a post-traumatic amnesia of 2 hours. Encephalography was undertaken because, 1 hour after injury, a convulsive attack, the significance of which was not evident, had been observed down the right side of the body. The other 8 cases all showed ventricular enlargement. In one (Case 33) a symptomless focal dilatation of the left frontal horn developed beneath the site of a healed compound depressed fracture. The remaining 7 cases were all examples of prolonged post-traumatic confusion with confabulatory disturbances (Korsakow's psychosis). All seven made complete recoveries, and subsequently showed generalized dilatations of one or both lateral ventricles. It is interesting that two of them (Cases 61 and 88), both with well marked ventricular dilatation, were pilots who later returned to full flying duties.

It will be seen that, though this group includes only cases which made complete recoveries, it is really highly selected in that in most of the cases

were examples of post-traumatic Korsakow's syndrome. It shows clearly that post-traumatic ventricular dilatation, even of moderate degree, is not necessarily associated with permanent psychological or neurological disturbances.

Head Injury with Residual Neurological Signs

A. With Residual Pyramidal Signs

Ventricular dilatation was observed in all except 2 of the 24 cases in this group. One of these two exceptions (Case 6) sustained a head injury of comparatively mild severity due to a blow on the right side of the head from a falling hammer. The skull was not fractured. The left arm was immediately paralysed, and slight permanent weakness of the arm was still evident 6 months later. The second exception (Case 9), was a case with a small, slightly depressed fracture in the mid-vertex over the superior longitudinal sinus, presenting slight residual sensory and motor signs in both lower limbs, more on the left side than on the right. A possible factor in the production of the clinical features shown by this case may have been a partial thrombosis of the superior longitudinal sinus beneath the depressed fracture.

In the remaining 22 cases (92 per cent.) the residual pyramidal disturbances were associated with ventricular dilatation. Six were examples of focal ventricular dilatation, 7 of unilateral ventricular dilatation, 6 of bilateral ventricular dilatation, and 3 of focal with unilateral general ventricular dilatation. It is interesting that with one exception the bigger ventricle was, appropriately, on the side opposite to that of the pyramidal disturbance. This relationship between the site of injury and the side on which symptoms appeared was further emphasized in Case 68, which showed bilateral pyramidal signs and bilateral ventricular dilatation; the side of greater ventricular dilatation was opposed to that of the greater motor signs. The exception to this rule was Case 44, in which a pronounced residual left hemiparesis was observed in association with a marked focal dilatation of the anterior part of the left lateral ventricle; there may have been some dilatation of the vestibule of the right lateral ventricle in this case but the degree of enlargement was very slight and opinions varied as to whether it was of pathological degree.

Particularly striking were the 7 cases (Cases 51, 55, 56, 57, 59, 60, 62) in which an apparently strictly unilateral ventricular dilatation was associated with corresponding pyramidal signs down the opposite side of the body. In one of these (Case 55) the degree of hemiparesis was very pronounced; in another (Case 57) the discrepancy in size between the two ventricles was particularly marked. An illustrative case history from this group is as follows:

Case 57.—A 24-year-old soldier received a closed head injury in April, 1940, as a result of a motor-cycle accident, which resulted in a post-traumatic amnesia of 2 weeks duration. Subsequently he complained of aphasia and of weakness of the right arm and leg which cleared up completely within a further 2 weeks. About 3 months after his injury he developed frequent epileptic attacks, which began with clonic movements of the fingers of the right hand, followed shortly by loss of consciousness for a few minutes. After many of the attacks he had aphasia and a transient right hemiplegia lasting for an hour. Between attacks weakness of the right lower face was evident, but no weakness or sensory disturbances in the limbs. X-ray examination showed a linear fracture in the left parietal region, and cisternal encephalography demonstrated a moderate dilatation of the whole of the left lateral ventricle. In view of the focal aura of his major attacks a left lateral craniotomy was performed and a small meningo-cerebral scar was found in the left pre-central gyrus.

This association of residual pyramidal signs with dilatation of the opposite ventricle occurs so frequently that it raises the question whether cases in which the pyramidal signs were only transient might not also show ventricular dilatation when examined at a later date. Our information as to the detailed signs shown by our cases in the acute stage is unfortunately incomplete, and we have records of only 7 such cases with transient pyramidal disturbances (Cases 58, 65, 86, 87, 89, 90, 100). It is interesting that either unilateral or bilateral ventricular dilatation was later demonstrated in all of them, and that the larger ventricle was always on the side opposite to that of motor dysfunction.

B. With Hypothalamic and/or Brain Stem Signs

Of the 4 cases included in this subgroup, only one (Case 41) showed ventricular dilatation. None had a fracture of the skull visible in the X-ray films. Three cases (Cases 28, 30, and 41), each with a prolonged post-traumatic amnesia of between 2 and 4 weeks duration, exhibited residual "cerebellar" ataxia down one side of the body without motor weakness. In one instance this was associated with nystagmus and dysarthria as well. The traumatic lesion responsible for these features was presumed to lie within either the brain stem of the cerebellum. Two of these three cases had normal encephalograms and the third some focal dilatation of the ipsolateral frontal horn. The remaining case (Case 22) in this subgroup was thought clinically to have had neurological lesions in the hypothalamus and upper part of the brain stem, which radiological examination showed were associated with a normal encephalogram. During the acute phase immediately following injury, the characteristic postures of decerebrate rigidity, associated with righting reflexes of the Magnus and de Kleyn type, were demonstrated. In the later stages the patient was left with a profound dementia, slight residual weakness of the right arm, and increased spasticity of both lower limbs. These four cases together suggest that cases of primary brain stem and hypothalamic injury are not usually followed by ventricular dilatation.

C. With Residual Optic Radiation Defects

An incomplete homonymous hemianopia of congrous type was observed in three cases (Cases 25, 49, 75). In each case there was a fracture in the parieto-occipital region, presumably associated with a

localized injury of the posterior part of the cerebral hemisphere. In no case did a dilatation of the related part of the lateral ventricle occur. In the first case (Case 25) the ventricular outlines were normal, in the second case (Case 49) there was a generalized dilatation of the opposite lateral ventricle from contrecoup, while in the third case (Case 75) there was a generalized symmetrical dilatation of both lateral ventricles. These three cases would seem to indicate that a localized cerebral injury is not necessarily followed by ventricular dilatation, but it must be remembered that ventricular changes in the occipital horns are often difficult to assess, owing to the wide range of normal anatomical variations.

D. With Cranial Nerve Palsies

In this group are included only cases in which cranial nerves were damaged, presumably within the cranial cavity, by injuries such as those involving the olfactory and oculomotor nerves or the optic chiasm. Cases in which the nerve was obviously damaged in its course through the skull, as in lesions of the optic nerve, the facial and auditory nerves, and the divisions of the trigeminal nerve were excluded.

Sixteen cases were found in the series, some with multiple lesions; 12 showed anosmia, 4 chismatic disturbances, and 3 oculomotor nerve palsies. The majority were associated with other residual neurological lesions which rendered it very difficult to determine the relationship between the state of the ventricles and the cranial nerve palsies. In 5 cases, however, cranial nerve palsies were noted as occurring without other residual sequelæ. Two of these cases showed bilateral anosmia and bitemporal hemianopia, one bilateral anosmia, one bilateral sixth nerve paresis, and one unilateral sixth nerve palsy. The ventricles were normal in three, showed focal dilatation in a fourth, and focal with generalized dilatation in the fifth. There is probably no direct relationship between the state of the ventricles and these cranial nerve palsies.

Post-Traumatic Syndrome and Post-Traumatic Intellectual Deterioration

Residual symptoms of intellectual disturbances, either subjective or objective, were observed in 53 cases. According as to whether subjective or objective features predominated, we divided these cases, as mentioned earlier, into two groups, a group of cases of post-traumatic syndrome in which headaches, giddiness, and lassitude were the characteristic features, and a group of cases of post-traumatic intellectual deterioration in which objective personality changes were conspicuous.

Twenty-nine cases were listed as examples of the post-traumatic syndrome. Collectively they were the result of injuries which clinically seemed less severe than those in the second group. In 3 out of the 29 cases (10 per cent.) there had not been any loss of consciousness, in 16 cases (55 per cent.) the post-traumatic amnesia was of 1 week or less, while in only 10 cases (35 per cent.) was it greater than 1 week. Radiological examination showed that of the cases of post-traumatic syndrome nearly half (14 cases, *i.e.* 48 per cent. of the group) showed normal ventricular outlines. In addition 3 cases (10 per cent.) showed focal enlargement of the ventricles, 6 (21 per cent.) unilateral ventricular dilatation, and 4 (14 per cent.) bilateral ventricular dilatation, while 2 cases (7 per cent.) showed combinations of focal and generalized ventricular dilatation.

Twenty-four cases were included in the second group of post-traumatic intellectual deterioration. By comparison with the first group, the injuries in this group were clinically more severe and were followed more frequently by ventricular dilatation. Thus a post-traumatic amnesia of one week or less was observed in only 6 cases (25 per cent.), whereas in 18 cases (75 per cent. as opposed to 35 per cent. in cases of post-traumatic syndrome) the duration of the post-traumatic amnesia exceeded a week. No cases of head injury without loss of consciousness were included in this group. Twenty-one out of the 24 cases (88 per cent.) showed ventricular dilatation. In 50 per cent. of these cases (12 cases), both lateral ventricles were affected; unilateral ventricular dilatation was observed in 4 cases (17 per cent.); focal ventricular enlargement in 5 cases (21 per cent.), and normal ventricular outlines in 3 cases (12 per cent.).

Post-Traumatic Epilepsy

Recurrent epileptic phenomena considered to be the direct result of the head injury were noted in 19 cases. Cases of epilepsy with antecedent attacks or with a known family history of epilepsy were excluded, as were all cases in which convulsive disturbances occurred only during the acute phases following injury. Grand mal seizures were observed in 12 out of the 19 cases, petit mal attacks in 2, grand mal associated with petit mal in 3, and focal motor seizures in 2 cases. Usually these attacks appeared some months after the injury, but in one case (Case 47), they apparently first appeared within a few hours of the accident, while in another case (Case 5), an interval of 3 years elapsed before the attacks appeared.

The incidence of post-traumatic epilepsy in our series appeared to bear no relation to the severity of the responsible injury, as measured by either the duration of the post-traumatic amnesia or the degree of ventricular dilatation. Thus 3 cases sustained injuries without loss of consciousness, 3 had post-traumatic amnesia of less than 1 day, 6 post-traumatic amnesia of 1 week, and 7 post-traumatic amnesia of more than 1 week. Again, of the 10 cases in which post-traumatic epilepsy occurred without other residual features, half showed normal ventricles and half dilated ventricles.

Discussion

It is evident from this analysis of our case material that ventricular dilatation of either a focal or a generalized character often follows closed head

injuries. Although dilatation may occur after apparently mild injuries, the frequency with which it is found increases with the severity of the trauma. These ventricular enlargements first appear within 2–3 weeks of injury and may reach their maximum within a month. They do not appear to be influenced so much by the site of the direction of the violence as by the presence of a fracture of the skull. Focal dilatations in particular tend to develop beneath the site of a localized fracture of the skull.

Although in some cases the correlation between the clinical signs and the encephalographic appearances is not at first apparent, in most there is an obvious relationship between the two. In particular, cases with residual pyramidal signs down one side of the body are frequently found to have dilatation of the lateral ventricle on the opposite side of the brain. Moreover, some of the remaining cases of ventricular enlargement were known to have presented signs of pyramidal disturbance in the acute phase of injury. Again, in cases with marked intellectual and mental deterioration both ventricles are often enlarged, whereas in cases without objective deterioration, but with only disorders of a subjective character such as headaches and dizziness, the ventricular system is more often normal. On the other hand the appearance of post-traumatic epilepsy does not seem to be connected with changes in the ventricular outline.

We strongly deprecate the view expressed by Swift (1932), Hauptmann (1931), Friedman (1932), and others that air encephalography can be used as a certain means of differentiating between cases with genuine disabilities and those with functional disturbances. These authorities, who have advocated the use of air encephalography in this connexion, have implied that, when the encephalograms are normal, the case should be regarded as of functional character. In our series of 31 cases with normal ventricular outlines following head injury, at least 6 cases had definite objective neurological signs indicating cerebral damage and 6 suffered from post-traumatic epilepsy. We therefore feel that the findings of a normal encephalogram in a given case does not prove that the symptoms are functional, because permanent organic damage can occur in the brain without resulting in later ventricular enlargement.

In this paper we have confined ourselves to a consideration of the ventricular changes, and have not paid attention to the other encephalographic features described in Bielschowsky's classical paper (1928). We do not consider non-filling of the ventricles with air to be evidence of pathological change, for we have observed on several occasions, after encephalography had failed to fill the ventricles, that ventriculography has revealed a normal ventricular system. Recently we met with a case in which, after lumbar encephalography had failed to outline the ventricles, encephalography repeated a few days later with air introduced by the cisternal route produced very satisfactory filling of the ventricles, which appeared normal. As during the period when our 100 cases were investigated there were only 4 cases of chronic head injury in which ventricular filling was not obtained, we have not felt justified in considering such cases as pathological and have consequently excluded them from our series.

Authors using lumbar encephalography have rightly laid great emphasis on abnormalities of distribution of the subarachnoid air. In our material these abnormalities have not been obvious, except in cases which also showed ventricular changes, and so we have not considered them. Cisternal encephalography, as performed in this hospital with the installation of only small quantities of air, does not lend itself to so clear a demonstration of the subarachnoid pathways as does lumbar encephalography. We feel this disadvantage of cisternal encephalography is outweighed by the advantage of being able to outline the ventricles clearly with smaller quantities of air, thereby causing much less distress to the patient.

The presence of ventricular dilatation after recovery from a head injury indicates that an atrophic process has taken place in the brain. Such an atrophic process may be the result of obstruction to the cerebro-spinal fluid pathways, or of resolution of the pathological changes produced in the brain itself by the trauma. Broadly speaking, post-traumatic ventricular dilatations are of two types, focal and generalized, and are probably produced by different mechanisms. It is unlikely that purely focal dilatations, for example, are due to the back pressure effects of obstruction to the cerebro-spinal fluid pathways, although such factors may operate in producing generalized dilatations. It is more likely that focal dilatation is the result of resolution of local pathological changes such as focal hæmorrhage, contusion, and laceration of brain tissue directly occasioned by the injury. The frequency with which focal dilatations develop beneath a localized fracture of the skull supports this view. In the production of generalized dilatation, other factors, which affect the brain more widely, must also operate. It is known that after head injury widespread pathological changes may occur in the brain, often remote from the actual site of injury, and may even overshadow the local injury (Hassin, 1940). Factors, such as œdema of the cerebral hemispheres and dilatation of the cerebral capillaries and veins, often with endarteritis (Winkelman and Eckel, 1934), may play a part in the widespread pathological processes. Traumatic subarachnoid hæmorrhage may also contribute to a generalized bilateral ventricular dilatation, as indicated by the experimental observations of Bagley (1928). However, it is difficult to explain why ventricular dilatation is apparently so frequently confined to one lateral ventricle, and may even reach a considerable degree in that ventricle without the other lateral ventricle being affected. It is unlikely that traumatic subarachnoid hæmorrhage or obstruction to the cerebro-spinal pathways, which would affect both ventricles equally, here play a part. It seems more

likely that the dilatation of the ventricle is the result of a vascular disturbance.

Whatever the explanation of the ventricular changes, the fact remains that, in addition to its use in demonstrating the presence of space-occupying lesions such as intra-cranial hæmatomata, air encephalography is a useful adjunct in the investigation of chronic head injuries. It affords a measurable indication of the extent of the gross atrophying processes consequent upon cerebral contusion, laceration, and traumatic vascular disturbance. It has its limitations in that finer degrees of cerebral injury can occur without subsequent alteration of the ventricular outlines.

Summary

1. The previous literature upon the subject of air encephalography after head injury shows that since 1928 there has been no review of any large series of cases from the aspect of correlation of the radiographic appearances with the clinical findings. In view of the improved clinical standards of assessment it was felt that the significance of the encephalographic changes should be evaluated in the light of these.

2. A series of 100 cases of closed head injury is presented, all of which were examined by a standardized technique, and a method of measurement of the ventricular bodies for the assessment of dilatation is described.

3. As control a series of 50 cases, in which the ventricular system was considered to be normal, was similarly examined.

4. The types of change in the ventricular outline encountered are described, and their time of onset and relation to the site of injury, to fracture and to the symptoms and physical signs presenting are discussed.

5. It would appear from the material that there is correlation between the ventricular changes and the clinical signs in the majority of cases, but that this may not always be so.

6. The mechanism of ventricular dilatation appears more likely to be due to intra-cerebral atrophic processes than to obstruction of the cerebro-spinal fluid pathways, as has previously been held by some writers.

7. Air encephalography cannot be regarded as a certain means of differentiating organic from functional post-traumatic states, as has been claimed. It does, however, afford a measurable criterion of the extent of atrophic processes occurring after cerebral damage.

We are much indebted to the medical officers of the military hospital for head injuries, under whose care these cases were, for their unfailing co-operation, and we wish to record our thanks to our Commanding Officer, Lieut.-Col. G. O. Chambers, M.C., for his permission to publish this paper. We also wish to express our thanks to T./Brigadier Hugh Cairns for his help and interest in this survey.

References

Abramovitch, D., and Winkler H. (1930). *Z. ges. Neurol. Psychiat.*, **127**, 454.
Bagley, A. (1928). *Arch. Surg.*, **17**, 18.
Bennett, A. E., and Hunt, H. B. (1933). *Arch. Surg.*, **26**, 397.
Bielschowsky, P. (1928). *Z. ges. Neurol. Psychiat.*, **117**, 55.
Cairns, H. (1941). *Brit. med. J.*, (ii), 465.
Davidoff, L. M., and Dyke, C. G. (1937). *The Normal Encephalogram*, Lea, Philadelphia.
Evans, W. A. (1942). *Arch. Neurol. Psychiat.* (Chicago), **47**, 931.
Fischer, M. (1927). *Arch. Psychiat. Nervenkr.*, **82**, 403.
Flugel, F. E. (1932). *Ergebn. inn. Med. Kinderheilk.*, **44**, 327.
Friedman, E. D. (1932). *Arch. Neurol. Psychiat.* (Chicago), **27**, 791.
Hassin, G. B. (1940). *Injuries of the Skull, Brain and Spinal Cord* (Edited Brock), London.
Hauptmann, A. (1932). *Arch. Psychiat. Nervenkr.*, **96**, 84.
Lippens, A., and Desjardin, L. (1934). *Pr. méd.*, **42**, 455.
Lysholm, E. (1935). *Acta radiol. Stockh.*, Supp. xxiv.
Money, R. A., and Susman, E. (1932). *Aust. N. Z. J. Surg.*, **2**, 47.
Schwab, O. (1926a). *Z. ges. Neurol. Psychiat.*, **102**, 294.
—— (1926b). *Dtsch. Z. Nervenheilk*, **89**, 44.
Swift, G. W. (1931). *Surg. Gynec. Obstet.*, **52**, 576.
Travers, J. T. (1937). *Radiology*, **28**, 704.
Winkelman, N. W., and Eckel, J. L. (1934). *Arch. Neurol Psychiat.*, **31**, 956.

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*Value of Quantitative Olfactory Tests for Localization of Supratentorial Disease: Analysis of One Thousand Cases. C. A. Elsberg and H. Spotnitz. 1.
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*Central Autonomic Paralysis. E. A. Stead, R. V. Ebert, J. Romano, and J. V. Warren. 92.
*Studies on the Corpus Callosum: v. Homonymous Defects for Color, Object and Letter Recognition (Homonymous Hemiablyopia) Before and After Section of the Corpus Callosum. A. J. Akelaitis. 108.

Case Reports:

*Diabetes Insipidus and Other Unusual Complications of Acute Purulent Sinusitis: Clinicopathologic Study of a Case. J. C. Yaskin, F. H. Lewey, and G. Schwarz. 119.

Quantitative Olfactory Tests and Supratentorial Disease.—In a considerable number of patients quantitative olfactory tests gave evidence of the location of the lesion. The largest number of positive results was found in patients with lesions in or around the frontal or temporal lobe of the brain. (R. M. S.)

Lissencephaly.—The case of a hydrocephalic child is reported in which the cerebral hemispheres were agyric, the corpus callosum absent, the subarachnoid space poorly developed, the cerebellum and cerebral cortex anomalous, and both eyes maldeveloped. The multiple anomalies in this case are considered to be due to a curious mixture of hypoplasia and dysplasia. The lissencephalic state in the human being is discussed and its rarity emphasized by a review of the literature, in which only five cases are reported. (R. M. S.)

Arnold-Chiari Malformation.—The Arnold-Chiari malformation consists of displacement of parts of the hindbrain through the foramen magnum into the upper part of the vertebral canal, and it can generally be identified by a tonguelike fold of cerebellar tissue extending caudally through the foramen and overlying the medulla. The author reports seven cases of which three were submitted to operation with one fatality. Two types are recognized. In the first there is no displacement of the fourth ventricle, and in the second a portion of the ventricular cavity is contained within the vertebral canal. This feature is a direct indication of the degree of elongation or stretching of the brain stem, and points to one of the causative factors in the abnormal development, viz., fixation of the spinal cord or its enveloping membranes to the bony vertebral canal at some point, with resultant stretching in many instances. A few of the associated developmental anomalies are mentioned, including platybasia, in which interest has recently been revived. The clinical aspects of the malformation, with the operative treatment, are discussed briefly. (R. M. S.)

Progressive Degenerative Encephalopathy.—In an infant born partially asphyxiated after a prolonged labour there developed progressive spastic diplegia, occasional convulsive seizures, and marasmus. Death occurred within twelve weeks of pneumonia and purulent meningitis. The brain showed maldevelopment, subcortical demyelination, liquefaction necrosis with cyst formation and underdevelopment, and degeneration of the cortex. The clinical and pathological aspects of the condition in this case resemble in most details those of " swayback " in lambs. In view of the fact that " swayback " has been shown to develop in utero and that in this comparable signs and sumptoms were apparent at the time of birth, the conclusion is justified that in the author's case the condition was of antenatal origin. The features described may help to strengthen further the viewpoint of those who believe that antenatal factors may explain some of the clinical syndromes often attributed to birth trauma. (R. M. S.)

Myelopathy following Compression of Abdominal Aorta.—A case of severe myelopathy following compression of the abdominal aorta for the control of a postpartum hæmorrhage is described. Despite the prolonged aortic compression, the resulting paraplegia disappeared over a period of months, but certain sensory disturbances persisted. Certain significant anatomical features of the vascular supply of the spinal cord are discussed. (R. M. S.)

Central Autonomic Paralysis.—The cases of six patients with lesions of the brain stem due to vascular thrombosis are described. Five of the six patients had a more or less typical lateral medullary syndrome due to occlusion of the posterior inferior cerebellar artery. The lesion in the sixth patient was probably due to thrombosis of a lateral branch of the superior cerebellar artery. In four cases there were minimal evidences of Horner's syndrome or sweating disturbances. In the two cases reported in detail sweating on heating the body and vasoconstriction on cooling the body were seriously disturbed, but vasodilatation on heating the body and vasoconstriction from a full inspiration or from sensory stimuli were normal. This study indicates that the efferent tracts concerned with various functions of the autonomic nervous system are at least in part anatomically distinct in the medulla, so that a lesion may destroy the tracts concerned with one or more functions of the autonomic system without interfering with the remainder. Central lesions of the autonomic nervous system produce signs that are different from those caused by the removal of the sympathetic ganglia or nerves, just as lesions in the sensory cortex produce signs that differ from those caused by sectioning a peripheral nerve or the posterior roots. (R. M. S.)

Corpus Callosum Studies.—Three cases of homonymous hemiamblyopia in epileptic patients with a history of head trauma are reported. In one case the hemiamblyopia was the only neurological sign observed. The localizing value of this type of homonymous defect is analysed and found to be limited. Complete or partial section of the corpus callosum produces no changes in the hemiamblyopic visual field. (R. M. S.)

Diabetes Insipidus Complication of Acute Purulent Sinusitis.—A case of pansinusitis, purulent osteitis, and necrosis of the right lesser wing of the sphenoid bone and the sella turcica, basilar meningitis with marked changes in the hypothalamic region and partial thrombotic occlusion of the right middle cerebral artery is reported. The unusual clinical features include rapidly progressive optic nerve atrophy, subarachnoid bleeding, transient diabetes insipidus, and hemiplegia. The pathogenesis of these manifestations is discussed. The pathological changes of the cerebral cortex in this case confirm the experience that the pial blood supply acts functionally as an end artery system, despite anatomical evidence to the contrary. (R. M. S.)

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*Metastatic Tumors of the Brain. J. H. Globus and T. Meltzer. 163.
*Cortical Reorganisation of Motor Function: Studies on Series of Monkeys of Various Ages from Infancy to Maturity. M. A. Kennard. 227.
*Pathology of Senile Brains: 1. Silver-Reducing Structures in the Hippocampus. L. S. King. 241.
*Delayed Traumatic Intracerebral Hemorrhage. R. N. De Jong. 257.
*Curare and Metrazol Therapy of Psychoses: Report of a Fatal Case. G. E. Charlton, W. C. Brinegar and O. R. Holloway. 267.
*Pathologic Anatomy of Human Nervous System in Avitaminosis. H. Ying-K'uei. 271.

Case Reports:
A Complication of Paravertebral Injection of Alcohol: Report of a Case. F. J. Hirschboeck and M. G. Gillespie. 320.

Metastatic Tumours of Brain.—The authors' material presents strong evidence that the metastatic cells are brought to the brain by the blood stream and not evidence of transportation of neoplastic cells to the brain by true lymphatics. The growth of a metastatic tumour in the brain takes place at the expense of adjacent brain tissue. Its extension is by way of the perivascular spaces and probably also by actual transportation of small cell groups through the vascular channels. In spite of its invasive character, a discrete line of demarcation between the metastatic tumour and the adjacent tissue is maintained, and only mild reactive changes, such as a narrow zone of condensation, gliosis, and occasional lymphocytic infiltration in nearby brain tissue, are present. In rare instances a narrow belt of hæmorrhage is observed, and this is particularly true of metastases from the so-called Grawitz type of tumour, or hypernephroma. Relatively wide areas of edema of surrounding brain tissue are common. The tumour tissue itself is usually rich in blood vessels, occasionally shows extravasation but most frequently contains relatively large areas of necrobiosis. A fairly large number of such tumours contain cysts filled with gelatinous material. In a small group of cases of metastatic invasion of the brain

the lesions are widespread in distribution but are restricted to infiltrations about blood vessels. These lesions are recognized only microscopically and are occasionally described as miliary carcinomas. The choroid plexus, which was studied with a view to determining its role in the transportation of tumour cells to the nervous system, was the seat of metastatic invasion in only one of fifty-seven cases. (R. M. S.)

Cortical Reorganization of Motor Function.—The cerebral cortex of the young monkey, Macaca mulatta, possesses greater capacity for reorganization than does that of the mature animal, as shown by recovery of motor function following bilateral ablation of areas 4 and 6. The greatest reorganization occurs during the first six months of life. The greatest loss of capacity to reorganize occurs during the end of the first year of life, at the same time that spasticity begins to appear. The recovery, previously shown to be due to reorganization of function in the remaining areas of the cortex, is slow and is maximal when ablations are carried out seriatim and with long intervals between extirpations. It is suggested that this is compatible with the anatomical structure and growth of the cortex, and that the dendritic connections of the motor neurons already present in the unexcised areas are reorganized during the period of recovery of function. (R. M. S.)

Pathology of Senile Brains.—Using a special technique the author studied the qualitative changes in cells of the hippocampal formation in senile brains. Special interest is centred on the pyriform cells in the pyramidal layer, in which the fibrils are sometimes of extreme delicacy, even though the cells may be undergoing dissolution. Pericellular argyrophilic structures, in intimate relation to many pyriform cells, are described. Some of this pericellular material is indistinguishable from that form of senile plaque known as the fine-fibred, hairlike type. Examples of transitional stages between pyriform cells and fine-fibred plaques are described, but these form only a small proportion of all plaques. No transition between any other type of plaque and any other type of cell change has been observed. Glia cells do not form or elaborate the material constituting senile plaques. Other types of silver-reducing substances observed in senile brains include short stretches of nerve and glial fibres, often in small groups and clusters; corpora amylacea; granulovacuolar degeneration of neurons; an argyrophilic change in blood-vessel walls, and an intra-epithelial network of fibres in ependymal cells. The interrelation of different types of pathological silver-reducing substances is briefly discussed. (R. M. S.)

Delayed Traumatic Intracerebral Hæmorrhage.—The cases reported show that head injury may result, even after a latent period, in severe damage to the brain. Inasmuch as alterations of the blood-vessel walls, cellular infiltration, and changes in blood pressure are not found, it seems justifiable to assume that the degenerative changes and resulting hæmorrhage are the result of vascular spasm. (R. M. S.)

Curare and Metrazol Therapy of Psychoses.—A case of sudden death following shock therapy with curare and metrazol is reported. In spite of their unfortunate experience, the writers believe that curare is a valuable drug in preventing injuries during shock therapy. (R. M. S.)

Pathological Anatomy in Avitaminosis.—An interesting account of an endemic of so-called secondary B complex avitaminosis in a group of 13 Chinese soldiers, who had suffered primarily from dysentery and tuberculosis. In all cases the neuropathological findings are fully described. For the most part these were characteristic of the changes found in beriberi and pellagra. (R. M. S.)

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*Experiences with Intramedullary Tractotomy: III. Studies in Sensations. L. M. Weinberger and F. C. Grant. 355.
*Effect of Certain Choline Derivatives on Electrical Activity of the Cortex. C. Brenner and H. H. Merritt, with technical assistance of M. G. Maguire. 382.
*Intracranial and Extracranial Vascular Accidents in Migraine. H. S. Dunning. 396.
Water Metabolism in Relation to Convulsions: II. Specific Gravity of Blood and Blood Serum. T. T. Stone, A. J. Arieff, and J. A. Luhan. 407.
*Neuropathologic Changes in Arteriosclerosic Psychoses and their Psychiatric Significance. D. Rothschild. 417.
*Intraneural Conditioning: Cerebellar Conditioned Reflexes. W. J. Brogden and W. H. Gantt. 437.
*Morquio's Disease Associated with Mental Defect. M. J. Farrell, J. D. Maloney, and P. I. Yakolev. 456.
*Surgical Removal of Brain Abscess Due to Bacillus Typhosus following Typhoid Fever. G. L. Odom and A. R. Elvidge. 465.
*Apraxia: Report of a Case with Autopsy. H. A. Teitelbaum, O. R. Langworthy, and A. B. King. 469.

Case Reports:

Complete Heart Block occurring during Insulin Shock Therapy: Report of a Case. A. R. Berger and W. Goldfard. 476.

Intramedullary Tractotomy.—Pathological lesions, because of their irregular size and intensity of distribution have obvious disadvantages when a study of the clinical effects relating to impairment of a single structure or of an isolated tract is desired. The operation of intramedullary tractotomy, in which the descending tract of the trigeminal nerve is transected, allows for the first time correlation of sensory changes with a small lesion accurately placed in the descending tract. As a result of the studies in twenty cases, the following conclusions are reached: Touch fibres are present in the descending trigeminal tract. Different pathways for pain sensation from the skin and mucous membranes seem demonstrable within the trigeminal tract. Pain fibres from the oral mucous membranes apparently lie most medially in the tract. Evidence is presented that separate pathways exist for pain and thermal sensibility in the descending trigeminal tract. Further evidence is presented indicating that the distribution of the trigeminal descending tract is in terms of peripheral divisions and that fibres from all three divisions may descend in the tract to a point below the obex. As in cases of subtemporal or subtentorial root section, the stability of sensory loss is not predictable. The area of analgesia may shrink. As this area decreases in size recurrence of pain is possible. Dysesthesias seem more infrequent after tractotomy than after posterior root section by the temporal route. (R. M. S.)

Derivatives and Electrical Activity of Cortex.—Animal experiments on the effect of three choline derivatives on the electrical activity of the cerebral cortex suggest the possibility that disorders in the metabolism of acetylcholine may be concerned in the ætiology or mechanism of convulsive seizures in human beings. (R. M. S.)

Vascular Accidents in Migraine.—The coincidence of an attack of migraine with cerebral hæmorrhage is reported. Changes in calibre of cranial vessels known to occur during attacks of migraine are probably predisposing factors in hæmorrhage and occlusion. (R. M. S.)

Neuropathological Changes in Arterio-Sclerotic Psychoses.—A neuropathological study of twenty-eight cases of psychoses with cerebral arteriosclerosis is reported. In all cases there was a variety of focal cerebral lesions, the most important of which were areas of softening and acellular or devastated areas. The observations indicated that the different types of focal lesions do not constitute separate anatomical or clinical forms of arteriosclerotic psychosis. The basal ganglia were more vulnerable than other parts of the brain, but in no case was the damage confined exclusively to these structures. A scrutiny of the relationship between the extent of the neuropathological changes and the degree of intellectual deterioration revealed numerous discrepancies; in many instances the psychosis could not be adequately explained by anatomical considerations alone. It is believed that the discrepancies are based on differences in the capacity of different persons to compensate for damage to the

brain. Examples are given to illustrate that cerebral lesions do not inevitably produce psychotic disturbances. Attention is directed to qualities of the living patient as an important factor in the origin of the mental disorder. It is suggested that patients with an ill-balanced mental makeup possess weaker compensatory powers and are thus more likely to acquire a psychosis than other persons with cerebral arteriosclerosis. (R. M. S.)

Intraneural Conditioning.—These experiments represent a study of intraneural conditioned responses established from movements initiated in the cerebellum. The cerebellar movements were produced by stimulation of the neocerebellum in chronic preparations (dogs), with induced electrical currents. The movements elicited were contractions of the ipsilateral ear, neck, or shoulder muscles; with moderate electric shock they occurred without evidence of pain or disturbance to the animal. Such movements were made the basis for conditioned responses by preceding the electric shock with a bell or light. Both excitatory and inhibitory conditioned responses could be formed from the cerebellum with the same ease that they can be formed by using a painful shock applied to the skin of the leg. Thus intraneural conditioned responses can be established on the basis of cerebellar movements. The cerebellum may have an independent higher integrative function, or this apparent integration may be brought about through the thalamus and the cerebral cortex. (R. M. S.)

Morquio's Disease.—In two cases of familial generalized osseous dystrophy of the Morquio type, in addition to the typical skeletal deformities gross mental deficiency was present. Mental defect has not hitherto been reported in Morquio's disease. (R. M. S.)

Surgical Removal of Brain Abscess due to Bacillus Typhosus.—The clinical history of a patient is presented who, four months after an attack of typhoid fever, was operated on for an expanding intracranial lesion in the left temporal lobe, which proved to be a cerebral abscess from which a pure culture of B. typhosus was obtained. The patient was discharged on the twentieth postoperative day, at which time neurological examination revealed nothing abnormal. (R. M. S.)

Apraxia.—A case of bilateral apraxia involving limb-kinetic, ideokinetic, and ideational disturbances is described. Postmortem studies of the brain revealed a large lesion involving the left supramarginal and postcentral gyri and smaller lesions in the centrum ovale of the left frontal lobe, including corpus callosum fibres to some degree. The fact that apraxia can be caused by focal lesions, as described in this case, does not justify the conclusion that there is a centre for eupraxia. Lesions in various sites can cause apraxia if they destroy essential cortical areas and association pathways. These are particularly vulnerable when the region of the left supramarginal tyrus is impaired in right-handed people. (R. M. S.)

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*Blood Coagulation in Disseminated Sclerosis and Other Diseases of Brain Stem and Cord. B. Simon. 509.
*Distribution of Alkaline Phosphatase in Normal and in Neoplastic Tissues of the Nervous System: A Histochemical Study. H. Landow, E. A. Kabat, and W. Newman. 518.
*A New Tendon Stretch Reflex: Its Significance in Lesions of the Pyramidal Tracts. V. E. Gonda. 531.
*Central Nervous System in Vitamin E-Deficient Rats. A. Wolf and A. M. Pappenheimer. 538.
*Significance of Insulin Inhibition by Blood of Schizophrenic Patients. M. G. Goldner and H. T. Ricketts. 552.
*The Pyramidal Tract: A Study of Retrograde Degeneration in the Monkey. A. M. Lassek. 561.
Intelligence in Cerebral Deficit States and Schizophrenia Measured by Kohs Block Test. T. Lidz, J. R. Gay, and C. Tietze. 568.
*Congenital Atresia of the Foramens of Luschka and Magendie. J. K. Taggart and A. Earl Walker. 583.
*Boeck's Disease (Sarcoid) of the Central Nervous System: Report of a Case, with Complete Clinical and Pathologic Study. T. C. Erickson, G. Odom, and K. Stern. 613.
*Vibratory Sensibility: A Quantitative Study of Its Thresholds in Nervous Disorders. J. C. Fox and W. W. Klemperer. 622.

Blood Coagulation in D.S.—It is suggested that in disseminated sclerosis there is a constitutional or acquired disorder of the blood-clotting mechanism which makes it more sensitive to exogenous or endogenous stimuli which tend to reduce the blood coagulation time. Intensive or repeated stimulation of this oversensitive mechanism may lead to intravascular thrombosis under certain conditions. The disorder of blood coagulation is characteristic of disseminated sclerosis and was not found in patients with the other diseases of the brain stem and spinal cord studied. (R. M. S.)

Alkaline Phosphatase in Neoplastic Tissues.—It is suggested that the phosphatase in vascular endothelium may play a role in the passage of dextrose through the capillary wall, similar to that suggested by Lundsgaard to explain the passage of dextrose through the intestinal wall of the proximal convoluted tubule of the kidney. The histochemical technique for phosphatase provides a uniquely effective method for demonstrating vessels, since it stains the vascular endothelium. By preparing thick serial pyroxylin sections and staining for phosphatase one may obtain a more complete picture of the vascular tree than that obtained by other methods. Studies of the vascular supply of various portions of the nervous system by this method are practicable. The method has a limited usefulness in diagnosis of tumours when employed in conjunction with other techniques. (R. M. S.)

Tendon Stretch Reflex.—The author describes a new tendon stretch reflex of the toes. The observer grasps the distal phalanx of any of the outer toes, preferably the fourth, between the thumb and the index finger. Then the toe is flexed downwards, describing the longest possible arc with considerable force so as to stretch maximally the tendons of the toes. The toe is held in this position for six to eight seconds in order to note a slow dosiflexion of the big toe. It is concluded that this new reflex is more sensitive in indicating involvement of the pyramidal pathways than are the other reflexes that have previously been used for this purpose. (R. M. S.)

C.N.S. in Vitamin E-Deficient Rats.—Under the exceptional conditions obtaining in their laboratory, Wolf and Pappenheimer were unable to induce lesions of the Central Nervous System in vitamin E-deficient rats at any age. (R. M. S.)

Insulin Inhibition by Blood of Schizophrenics.—Experiments on the insulin-inhibiting power of blood of normal and of schizophrenic patients are reported. The relation between insulin inhibition by blood and clinical insulin resistance is discussed. No indication of the presence of an anti-insulin factor in the blood of schizophrenic patients could be found. (R. M. S.)

Pyramidal Tract.—Retrograde degeneration with breakdown and loss of neurons does not occur in the pyramidal system of the monkey after section of the pyramidal fibres. Changes occur in the so-called Betz, or giant, cells of area 4, characterized by shrinkage and loss of Nissl substance, so that the normal configuration of these cells is lost. The Nissl substance may not be concerned with the nutrition and metabolism of the axon. The author believes that retrograde method fails to prove that the so-called Betz, or giant, cells give sole origin to the pyramidal tract fibres. The question is raised whether retrograde degeneration with dissolution of axis-cylinders can be produced in the spinal cord and brain stem of the central nervous system. (R. M. S.)

Congenital Atresia.—Three cases of congenital atresia of the foramens of Luschka and Magendie are presented in detail. The pathogenesis of the enormous dilatation of the fourth ventricle and the lack of development of the posterior part of the vermis are explained on an embryological basis. (R. M. S.)

Boeck's Disease.—Sarcoid of the central nervous system has been recognized with extreme rarity. The authors' case presented a clinical picture of adhesive arachnoiditis with internal hydrocephalus, due to blockage of the

cerebrospinal fluid pathways about the foramen magnum. Suboccipital craniotomy revealed herniation of the tonsillar lobes of the cerebellum, with dense arachnoid adhesions. Biopsy specimens from the cerebellum and arachnoid showed a granulomatous process identical with that in specimens taken from a nodular lesion of the upper lip, and a diagnosis of Boeck's sarcoid was thus established during life. The patient died shortly after receiving a series of high-voltage Röntgen ray treatments six months after operation. Post-mortem examination showed adhesions and exudate over the base of the brain and over the dorsal aspect of the lower portion of the brain stem. Microscopically there was meningoencephalitis, characterized by isolated and conglomerated foci made up of numerous epitheloid cells, giant cells, round cells, and plasma cells. Similar lesions, but with more tendency to necrosis, were observed in the lung. (R. M. S.)

Vibratory Sensibility.—Vibratory sensation should be conceived of not as a specific modality but as a functional form or elaboration of the primary senses—touch, pressure, and position. In its temporal aspect for tactual perception it is analogous to flicker sense in visual perception and to flutter sense in auditory perception. (R. M. S.)

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*Toxoplasmic Encephalomyelitis: VI. Clinical Diagnosis of Infantile or Congenital Toxoplasmosis; Survival beyond Infancy. D. Cowen, A. Wolf, and B. H. Paige. 689.
*Acute and Subacute Toxic Myelopathies following Therapy with Arsphenamines. B. W. Lichtenstein. 740.
*Insulin Sensitivity of Patients with Mental Disease: Factors in their Serum affecting Action of Insulin. M. M. Harris. 761.
*Effects of Destruction of Hypothalamus by Tumor. V. P. Collins. 774.
*Spinal Epidural Granuloma: Report of a Case. J. V. Warren and J. Romano. 789.
Effect of Iodized Poppyseed Oil on the Spinal Cord and Meninges: An Experimental Study. R. L. Craig. 799.
*Use of Testosterone Proprionate in Treatment of Involutional Psychosis in the Male. E. Davidoff and G. L. Goodstone. 811.
Fatality following Intravenous Administration of Magnesium Sulfate: Report of a Case. M. Rosenbaum and S. D. Lipton. 818.
*Amphetamine Sulfate in Treatment of Spasmodic Torticollis: Report of Two Cases. A. Myerson and J. Loman. 823.

Toxoplasmic Encephalomyelitis.—A review of the symptoms in nine cases of infantile, or congenital, toxoplasmic encephalomyelitis recognized at necropsy permitted the formulation of a clinical picture of the disease. The children all died during infancy, usually in the early weeks or months of life, in the acute or subacute stage. The outstanding feature of the syndrome was the concomitant occurrence in infants at or soon after birth of striking ocular lesions and neurological symptoms and signs. The ocular signs consisted of multiple focal, bilateral areas of chorioretinitis, almost invariably involving the macula, with less constant microphthalmos, nystagmus, and ocular palsies. The neurological findings included convulsions, hydro-cephalus, and, as the most striking sign, multiple foci of intracerebral calcification. On this basis, the first six clinically identified cases have been diagnosed and are reported here. In the majority of these the patients are children who have survived beyond infancy, indicating that, contrary to previous experience, the infection is not uniformly fatal and may become chronic, healed, or latent. An analysis of the findings in these six cases reveals that at this stage the clinical picture consists chiefly of the residual effects of the lesions occurring in the acute or the subacute stage. In these older children the outstanding symptom is usually diminution in vision due to the effects of multiple foci of healed chorioretinitis, which are readily identifiable ophthalmoscopically. Strabismus, microphthalmos, and minor congenital ocular defects may also be present. Generalized convulsions or petit mal attacks may persist or later make their appearance. Internal hydrocephalus may become chronic and progressive. Foci of intracerebral calcification persist and may at first increase in number and size. Retardation in the development of speech and minor degrees of mental deficiency occur. The intrauterine inception of the disease in many, if not all, of these patients is stressed. The fact that these children often survive into the juvenile period would make it desirable to refer to this form of toxoplasmosis as infantile, or congenital, toxoplasmic encephalomyelitis to distinguish it from toxoplasmosis which may be acquired during the juvenile period and in adult life. These forms might be termed juvenile and adult acquired toxoplasmosis respectively. It may be that a type of acquired infantile toxoplasmosis exists. Infantile, or congenital, toxoplasmic encephalomyelitis is evidently not a rare disease. It is believed that many cases may have been erroneously classified as instances of congenital malformation of the brain, cerebral birth injury, epilepsy, congenital hydrocephalus, etc. The identification of additional cases may yield some knowledge as to the epidemiology of the disease. In any event, the present indications are that the infection is widespread in the United States, and cases have been encountered in South America and Europe as well. Various mammals, and perhaps birds, are probably the animal reservoirs of the infection, but the mode of transmission to man is not yet known. The use and limitations of a serological method as a diagnostic aid are discussed. (R. M. S.)

Toxic Myelopathies and Arsphenamines.—The arsphenamines produce changes in the nervous system through the medium of the blood vessels and/or by direct action on the parenchyma. In classic instances of "postarsphenamine encephalitis" the drug affects the blood vessels, and this may result in perivascular areas of necrosis and/or hæmorrhage. In classic instances of "postarsphenamine myelitis" the drug affects the parenchyma. The histological alterations in this disorder are pleomorphic and may be classified as (**a**) degeneration of the ganglion cells, the myelin or the nerve fibres, with proliferative changes in the astroglia; (**b**) malacia; (**c**) necrosis; and (**d**) inflammatory phenomena—perivascular and leptomeningeal infiltration of lymphocytes and plasma cells and, rarely, of polymorphonuclear leukocytes. In some instances of "postarsphenamine myelitis" the histological alterations are similar to those seen in the brain in classic instances, namely, vascular alterations resulting in perivascular hæmorrhages. In many instances a combination of various parenchymatous changes with or without vascular phenomena are encountered. The postarsphenamine myelopathy is, as a rule, located in the lower thoracic and the lumbar portion of the spinal cord. The parenchymatous alterations may extend into the brain stem or even higher. Postarsphenamine myelopathy is usually associated with degeneration of the peripheral nerves. The disorder is usually ascending, acute, or subacute in course, and death results from respiratory paralysis or sepsis. In non-fatal cases there is evidence of permanent damage to the spinal cord. The disorder is probably the result of sensitivity of the nerve tissues or the vascular bed to the arsenic, and is not modified by the age, sex, or physical condition of the patient. The disorder must be differentiated from syphilitic myelitis, the Herxheimer reaction, multiple sclerosis, and disseminated encephalomyelitis of unknown origin. (R. M. S.)

Insulin Sensitivity and Mental Disease.—A group of sixteen patients, consisting of thirteen with dementia præcox, two with psychoneurosis, and one with a neuroendocrine disturbance, were tested as regards their sensitivity to test doses of insulin as reflected by the changes in the blood sugar level, according to the method of Csepai and Ernst. Of the patients with dementia præcox, some showed a normal response, and others either an increased or a decreased sensitivity to the test dose of insulin. A group of seven patients with dementia præcox were studied by a method similar to that of de Wesselow and Griffiths with regard to the possible presence of substances in the serum which affect the

action of insulin. The serum of some of the patients showed a pronounced antagonistic effect on the action of insulin, while others showed little or no effect. The results obtained with both tests were compared with the report of Meduna and his co-workers, in which it was claimed that increased amounts of substances antagonistic to the action of insulin were present in the blood of schizophrenic patients. The possible role of insulin antagonism in the pathogenesis of dementia præcox is discussed and the need for further investigations indicated. A patient with depression associated with a combined Parkinson and Cushing syndrome showed evidence of resistance to the blood sugar-lowering effect of insulin, associated with slow recovery to the initial blood sugar level. The latter effect is in keeping with the claim of Fernbach that patients with Parkinson's disease show slow recovery from the depressed blood sugar level. The delayed recovery from the lowered blood sugar level observed in the patients with dementia præcox may indicate a disturbance in the physiology of the neurovegetative system. No strict correlation was found between the tests and the subsequent dose of insulin required to produce coma during insulin shock. The significance of this observation is discussed. (R. M. S.)

Destruction of Hypothalamus by Tumour.—The following abnormalities are ascribed to the destruction of the hypothalamus by tumour: diabetes insipidus; suppression of function of the anterior lobe of the pituitary, the thyroid, the ovaries, and the adrenal glands; disturbance of fat metabolism; disturbance of sleep; disturbance of thermal regulation, and disturbance of personality. The role of the thyroid in diabetes insipidus is demonstrated and information bearing on the anatomical and physiological relationship between the hypothalamus and the anterior lobe of the pituitary gland is presented. (R. M. S.)

Spinal Epidural Granuloma.—The case of a patient with spastic-ataxic paraplegia due to compression of the cord by an epidural granuloma associated with Staphylococcus aureus is presented. The case presented considerable difficulty in diagnosis because of the coincidence of syphilis, hypertensive cardiovascular disease, alcoholism, and nutritional deficiency. Absence of cells in the spinal fluid below the subarachnoid block was a further source of confusion. Surgical removal and subsequent drainage of the granulomatous area led to considerable improvement. (R. M. S.)

Testosterone Propionate and Involutional Psychosis.—Twenty male patients suffering from involutional psychoses were treated with testosterone propionate, administered intramuscularly for a period of from six weeks to three months. Sixty-five per cent. of the patients responded well. In the control group treated by procedures previously employed, only 46 per cent. improved. The best results were obtained with the mild and moderately severe types. The severe type did not respond well to androgenic therapy and may represent a different clinical entity from the other two. The therapeutic test with testosterone proprionate may be of some diagnostic value in differentiating the milder type, in which androgenic deficiency is an important etiological factor, from the more severe type, in which other psychological or organic factors predominate. (R. M. S.)

Amphetamine Sulphate and Torticollis.—Two cases of spasmodic torticollis which responded remarkably to amphetamine sulphate are reported. Scopolamine was used as a synergist to counteract central overstimulation of the amphetamine sulphate. Although given in large doses, no injurious effects of the latter drug were observed. In the second case nicotinic acid appeared to enhance the effect of the amphetamine sulphate. (R. M. S.)

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*Relief of Pain by Mesencephalic Tractotomy. A. Earl Walker. 865.
*Somatotopic Localization of Spinothalamic and Secondary Trigeminal Tracts in Mesencephalon. A. Earl Walker. 884.
*Problem of Imperception of Disease and of Impaired Body Territories with Organic Lesions: Relation to Body Scheme and Its Disorders. J. Gerstmann. 890.
*Studies on the Corpus Callosum: VI. Orientation (Temporal-Spatial Gnosis) following Section of the Corpus Callosum. A. J. Akelaitis. 914.
*Removal of Malignant Thymoma in a Case of Myasthenia Gravis. F. Turnbull. 938.
*Convulsions in Nonepileptic Patients on Withdrawal of Barbiturates, Alcohol and Other Drugs. L. B. Kalinowsky. 946.
Electroencephalogram accompanying Hyperactive Carotid Sinus Reflex and Orthostatic Syncope. F. M. Forster, E. Roseman, and F. A Gibbs. 957.
*Effect of Hyperventilation on Electroencephalogram of Schizophrenic and Nonpsychotic Subjects. M. A. Rubin, with the assistance of E. Turner. 968.
Ligation and Resection of the Superior Longitudinal Sinus. J. R. Jaeger. 977.
*True Fatty Degeneration in Sensory Necrons of the Aged. R. C. Truex and R. L. Zweimer. 988.

Mesencephalic Tractotomy.—The convergence of the spinothalamic and the secondary trigeminal tracts in the pons makes it possible to section the pain pathways from one-half of the body without appreciably damaging other nerve structures. This may be accomplished in the upper part of the pons or the mesencephalon. Dogliotti, who first suggested section of these pathways in the brain stem, made his incision in the rostral portion of the pons. Because of the easier surgical approach and the clearer surface markings of the pain tracts in the mesencephalon, this level seems more favourable for the section. The procedure produces hemianalgesia and hemithermanesthesia on the side of the body opposite the lesion immediately after the operation, with a peculiar feeling of " numbness " or " deadness." There is slight weakness of the contralateral leg, demonstrable only by having the patient hop or stand on that leg alone. Co-ordination is normal. Proprioceptive sensibilities are not impaired. (R. M. S.)

Localization of Spinothalamic Trigeminal Tracts.—The orientation of the pain fibres in the mesencephalon is perhaps an expression of their final disposition in the thalamus and an example of neurobiotaxis. It has been shown that the fibres from the lumbar segments of the spinal cord tend to end in the lateral parts of the nucleus ventralis posterior of the thalamus, while those from the spinal trigeminal root terminate medially. This arrangement, like the other topical organizations, is not an absolute one, and there is much apparent, if not real, overlap of adjacent segments. A similar somatotopic orientation in the mesencephalon might well illustrate the principle of neurobiotaxis. (R. M. S.)

Imperception of Disease.—A study of the phenomena of imperception of disease and of the related types of amnesia for or non-recognition of or consecutive psychotic production with respect to the impaired parts, or side, of the body is studied. (R. M. S.)

Corpus Callosum.—In twenty-six cases of epilepsy, orientation was studied before and after operation, in which the corpus callosum was sectioned partially or completely. The conclusion is reached that temporary confusion follows this operative procedure only when there is co-existent unilateral involvement of the posterior portion of the right or left hemisphere. (R. M. S.)

Malignant Thymoma and Myasthenia Gravis.—A case of myasthenia gravis associated with malignant thymoma is reported. Successful removal of the thymic tumour did not result in any improvement of the myasthenia gravis. (R. M. S.)

Convulsions in Non-Epileptic Patients.—The cases of seven non-epileptic patients who had convulsions four days after withdrawal of soluble barbital are reported; they had been accustomed to this sedative for one to two years. None of them had seizures prior to or after this occurrence. The dangerous increase of seizures in epileptic persons following sudden discontinuance of phenobarbital is explainable by the same mechanism. It seems that in this respect phenobarbital acts differently from other anticonvulsive drugs, such as bromides and

dilantin. No immediate action of the drug, but some unknown physico-chemical process developing after withdrawal in a chronically intoxicated patient, seems to be responsible for both the convulsions and the withdrawal psychosis. (R. M. S.)

Hyperventilation and E.E.G.s of Schizophrenics.—Schizophrenia appears to increase the resistance of the central nervous system to the influence of hyperventilation. This is consistent with the general physiological unresponsiveness of schizophrenic persons. (R. M. S.)

Fatty Degeneration in Sensory Neurons of Aged.—A study of aged human and animal sensory ganglion cells shows widespread fatty degeneration. This change is demonstrable as actual fat droplets when specific stains are applied to frozen sections, but appears as vacuoles in paraffin-silver preparations. Immediate fixation of the material of experimental animals precludes the possibility that these changes in the nerve cells represent post-mortem autolysis. The alterations are therefore valid ante-mortem changes. (R. M. S.)

BRAIN

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*The Effect of Prolonged Increased Cerebrospinal Fluid Pressure on the Venous Pressure in the Superior Longitudinal Sinus of the Dog. T. H. B. Bedford. 233.
*The Effects of Striatal Injury. F. A. Mettler and C. C. Mettler. 242.
*Electroencephalographic Studies in Epilepsy. K. H. Finley and J. B. Dynes. 256.
*Intracranial Conditions after Closed Head Injuries. A. A. McConnell. 266.
The Repair of Large Gaps in the Peripheral Nerves. F. K. Sanders. 281.

Prolonged Increased C.S.F. Pressure and Venous Pressure.—The pressure in the superior longitudinal sinus in four dogs with chronic high cerebrospinal fluid pressure of unknown origin has been measured, and the effect of varying the fluid pressure upon the venous pressure in the sinus has been studied in two of them. Although the sinus pressure was found moderately raised in each, it fell slightly when the cerebrospinal fluid pressure was raised, and rose similarly when the fluid pressure fell. This was due to a mechanical obstruction, caused by slight collapse of the sinus where it enters the bone at the torcular, in turn caused by the high cerebrospinal fluid pressure. The normal compensating mechanism which regulates cerebral blood flow was therefore impeded and venous pressure consequently changed. (D. J. W.)

Striatal Injury.—Although small unilateral lesions of the striatum may produce no detectable change in motor function, bilateral large lesions produce profound changes. The authors performed bilateral removal of the caudate nucleus in cats who had previously had a bilateral frontal decortication. The animals survived for several days and were observed during that time. They showed violent hyperkinetic movements, with spontaneous running movements, extensor thrusts, and leaping when placed in a vertical position. This extreme hyperkinesia is produced by ablation of the caudates, and is not due to uncomplicated decortication. The activity is not due to irritation, but it is a release phenomenon. (D. J. W.)

E.E.G. Studies in Epilepsy.—A further evaluation of the e.e.g. in epilepsy has been made. Fourteen per cent. of records in 625 epileptics were considered normal. Many of the abnormalities found in the epileptics are found in other psychiatric conditions. The variation of the abnormalities seen in epilepsy is so great that although the authors divided their records into 18 standard types, no type made up more than 10 per cent. of the cases. This variability is also seen in other neurological and psychiatric conditions. When the epilepsies are divided clinically it is found that there are no consistent characteristic patterns for any one type of epilepsy, consequently the division of the changes seen in the e.e.g. of epileptics upon a clinical basis is misleading and undesirable. For instance, high voltage fast activity only occurred in 14 per cent. of their cases of grand mal, and it is more often seen in cyclothymic psychoses than in epilepsy, and the wave and spike phenomenon which was only found in 10 per cent. of subjects, was not confined to patients with petit mal. They found wave and spike activity in 5 of about 4,000 non-epileptic abnormal subjects. After reviewing the subject the authors conclude that the time has not yet arrived to make any formal classification of electro-encephalographic changes in epilepsy, although the usefulness of the method appears established. (D. J. W.)

Intracranial Conditions after Closed Head Injuries.—There is no uniformity in the intracranial conditions found after closed head injuries with concussion. Clinical examples of personal cases are described, under the headings of semi-coma, traumatic delirium, confusion, and traumatic dementia. (D. J. W.)

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*The Efferent Pathway for Pupillary Contraction. P. W. Nathan and J. W. Aldren Turner. 343.
*Oligodendrogliomatosis of the Cerebrospinal Pathway. D. J. K. Beck and D. S. Russell. 352.
*Functional Recovery following Nerve Grafts and Other Types of Nerve Bridge. E. Gutmann and F. K. Sanders. 373.
The Giant Cells of Betz, the Motor Cortex and the Pyramidal Tract: A Critical Review. F. M. R. Walshe. 409.

Efferent Pathway for Pupillary Contraction.—Two cases are described of Argyl Robertson pupil resulting from injury to the peripheral pathway of the pupillo-constrictor nerves, and further cases have been collected from the literature. The findings in these cases show that an efferent peripheral pathway for pupillo-constriction serving accommodation was destroyed, while that for light was preserved. The only practicable route by which fibres subserving constriction to accommodation could reach the pupil, apart from the known efferent pathway through the ciliary ganglion and short ciliary nerves, is by the episcleral ganglia, described by Axenfeld in 1907. The ganglia send fibres to the ciliary muscle, and they follow the usual pattern of parasympathetic innervation in that they are situated close to the organ which is innervated. The authors consequently suggest that the fibres concerned in the synkinetic contraction of the pupils on accommodation and convergence run from the third nucleus to the episcleral ciliary ganglia, thence relaying to the ciliary body, without passing through the ciliary ganglion. (D. J. W.)

Oligodendrogliomatosis of Cerebrospinal Pathway.—Four cases are described in which diffuse spread of oligodendroglioma occurred throughout the subarachnoid space. The dissemination was spontaneous, and involved the spinal theca. Histologically some of the secondary fibrous changes seen suggested a chronic arachnoiditis of unknown origin, but on the other hand some of the tumour had proliferated as actively as do the more malignant gliomas. In none of these cases were free tumour cells abundant in the cerebrospinal fluid, and the damage done to basal structures was not commensurate with the degree of infiltration by tumour tissue The authors think it likely, in view of the variable clinical picture, that diffuse oligodendrogliomatosis has in the past gone unrecognized and misdiagnosed, even after histological examination. (D. J. W.)

Functional Recovery following Nerve Grafts.—The rate

of recovery after peronal nerve section in rabbits was measured by means of the toe spreading reflex and return of pain sensation in the dorsum of the foot, in cases where repair had been by (a) unaided union; (b) end-to-end suture; (c) different types of nerve graft. In no case was recovery complete, end-to-end suture and autografts giving the best functional results, unaided union, and alcohol fixed grafts giving the worst. The results are given in detail for time of reflex and sensory recovery and for degree of ultimate recovery. Sensory recovery followed the same course as reflex in each type of repair, but was uniformly slower and less certain. Microscopic and histological examination of the repairs showed changes ranging from that of the autografts, which was indistinguishable from a normal peripheral stump, to alcohol fixed grafts, which showed so much destruction and replacement by the host tissues that they resembled the strands connecting the stumps in unaided unions. The histological recovery paralleled the clinical, but even in the fibrous strands of unaided unions or of alcohol fixed grafts myelinated fibres could be found after 200 days. The fibres were largest in autografts and smallest in alcohol fixed grafts. (D. J. W.)

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Studies on Blood Coagulation: The Nature and Properties of a Proteolytic Enzyme Derived from Plasma. M. H. Kaplan, H. J. Tagnon, C. S. Davidson, and F. H. L. Taylor. 533.

The Digital Blood Flow, Arterial Pressure, and Vascular Resistance in Arterial Hypertension and in Coronary Thrombosis. M. Mendlowitz. 539.

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*Observations on the Nature of Myasthenia Gravis. The Effect of Thymectomy on Neuromuscular Transmission. A. M. Harvey, J. L. Lilienthal, and S. A. Talbot. 579.

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The Velocity of Blood Flow in Infants and Young Children, determined by Radioactive Sodium. J. P. Hubbard, W. N. Preston, and R. A. Ross. 613.

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Electrophoretic Study of Protein Components in C.S.F. and Relationship to Serum Proteins.—The authors show that the electrophoretic pattern of proteins in the C.S.F. resembles that of blood and changes with it. However, in neurosyphilis an increased gamma globulin occurs in the C.S.F. only. The colloidal gold reaction is shown to be dependent upon the gamma globulin fraction. (J. N. C.)

Observations on the Nature of Myasthenia Gravis.—Extirpation of the thymus in five patients yielded favourable clinical results in three cases. Electromyographic studies were performed, and also showed evidence of improved muscular action. (J. N. C.)

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Studies in Renin: The Duration of the Pressor Effect of Large Doses in Conscious Normal and Renally Abnormal Dogs. Observations on Anethetized and Uremic Dogs and the Anaphylactic and Pathological Effects of Pig Renin. L. Letter and L. Eichelberger. 11.

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Phenylpyruvic Oligophrenia.—A patient with phenylpyruvic oligophrenia was examined and studies on the metabolism of phenylalamine and tyrosine carried out, and the results were in agreement with the theory that the primary metabolic defect is an inability to handle phenylalamine. (J. N. C.)

Community Study of Carriers in Epidemic Poliomyelitis.—A description is given of the methods and results obtained in examining the stools of the majority of a community to determine the distribution of poliomyelitis in the population at risk in a post-epidemic period. (J. N. C.)

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A Suggested Treatment of Spinal Block caused by Spinal Adhesive Arachnoiditis by Means of Repeated Spinal Air Injection. H. D. McIntyre. 668.
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*Impedance Changes in Frog's Muscle Associated with Electrotonic and "Endplate" Potentials. B. Katz. 169.
Some Physiological Aspects of Audiogenic Seizures in Rats. D. B. Lindsley, F. W. Finger, and C. E. Henry. 185.
*Responses during Refractory Period at Myoneural Junction in Isolated Nerve-Muscle Fibre Preparations. S. W. Kuffler. 199.
*Effect of Eserine on Neuromuscular Transmission. J. C. Eccles, B. Katz, and S. W. Kuffler. 211.
Excitability of Cerebral Cortex in Infant *Macaca Mulatta*. M. A. Kennard and W. S. McCulloch. 231.
*Effects of Presynaptic Volleys on Spread of Impulses over the Soma of the Motoneuron. B. Renshaw. 235.

Impedance Changes in Frog's Muscle.—Following a brief sub-threshold current pulse there is in the isolated sartorius of the frog an impedance loss at the cathode and a smaller impedance increase at the anode. The time course of decay is approximately the same as that of end-plate potentials and of the electrotonic potential of muscle. With threshold currents propagated spikes start at the cathode at a moment when the impedance loss reaches its peak. Impedance changes set up by a nerve volley and measured with A.C. of 5,000 c.p.s. are about 10 per cent. for the spike potential and 0·1 per cent. for the end-plate potentials (e.p.p.). The impedance change in completely curarized muscle has the same latency and lasts as long as the e.p.p. The rising period of the impedance change is shorter (slightly more than one-half), and its initial fall more rapid than that of the e.p.p.; during the later phase of decay the time course of the impedance change is identical with that of the e.p.p. The possible role of A.C. in providing a cation of high penetrating power and in so altering the membrane impedance is discussed. (W. M. H.)

Responses in Nerve Muscle Fibre.—Electrical responses set up by a nerve impulse at the junctional region during the refractory period have been investigated in the single nerve muscle fibre preparation of the frog. They are of three types: (**a**) an end-plate potential; (**b**) abortive impulse; and (**c**) fully propagated impulse. Abortive impulses may travel small distances and may attain 30 per cent. of the full spike potential. E.p.p. set up by a conditioning nerve impulse lengthens the muscle refractory period. (W. M. H.)

Eserine and Neuromuscular Transmission.—In cats' and frogs' muscle eserine increases and lengthens the local negative potential changes at the myoneural junction. Repetitive nerve volleys produce a delayed slow wave at the junctional region. (Curare antagonizes these two effects, but even in curarized muscle eserine causes a prolongation of e.p.p. Repetitive muscle impulses can arise in the eserinized muscle independently of nerve after discharge. Another effect of increased and prolonged catelectrotonus is seen in a lengthening of the refractory period and, during very intense depolarization, a complete block of impulse propagation. The chief effect of eserine is thus in lengthening the action of the neuromuscular transmitter. The curare eserine antagonism cannot be explained by an effect on the inhibition of cholinesterase by eserine, nor by a quickened adaptation of muscle to acetyl choline. The assumption that curare diminishes the rate of surface spread by blocking its combination with the receptors is discussed. (W. M. H.)

Presynaptic Volleys and Spread of Impulses.—A centripetal volley of impulses from the ventral root fibres of cats and rabbits produces in the ventral horn a brief initial positive potential change, a negative deflection of 1–2 m. sec., due probably to the invasion of the motoneural soma, then a prolonged and smaller positive phase. A rapid series of centripetal volleys evokes negative deflections of diminishing size. Conditioning dorsal root volleys alter the motoneuron soma response variously. It is concluded that retrograde conduction in the motoneurons occurs with a decrement, the degree of penetration into the cell body and dendrites being augmented or decreased by the consequences of the activity in sensory and premotor neurons. (W. M. H.)

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*Positional Nystagmus in Cerebellar Lesions. E. A. Spiegel and N. P. Scala. 247.
*Effect of Alkalosis and Acidosis on Cortical Electrical Activity and Blood Flow. A. J. Lubin and J. C. Price. 261.
A Deficiency in the Phrenic Respiratory Discharges Parallel to Retrograde Degeneration. G. H. Acheson, E. S. Lee, and R. S. Morison. 269.
*Origin, Conduction and Termination of Impulses in Dorsal Spino-Cerebellar Tracts of Cats. H. Grundfest and B. Campbell. 275.
*Interference Factors in Delayed Response in Monkeys after Removal of Frontal Lobes. R. B. Malmo. 295.
*Further Study on Transmission in an Isolated Nerve-Muscle Fibre Preparation. S. W. Kuffler. 309.

Positional Nystagmus.—Abnormal positions may accentuate or disclose nystagmus after lesions of parts of the cerebellum in the cat. Labyrinthectomy abolishes this effect of position, and it is suggested that cerebellar lesions may have the effect of releasing vestibulo-ocular reflex arcs. In suspected cerebellar lesions, therefore, tests for positional nystagmus should be made. (W. M. H.)

Alkalosis and Acidosis and Cortical Electrical Activity.—In cats the effect of acid and alkali injected intro-veneously, on electroencephalograms and the pial arteries, was studied. Amounts which produced changes in the respiratory rate of the anæsthetized cat do not disrupt the cortical potentials. Alkalosis changes cortical activity only if an abnormal pattern has already been established, as in hypoglycæmia. Injection of acid causes dilation and alkali constriction of the pial arteries in most cases. These changes can therefore not be related to alterations in the cortical potentials. (W. M. H.)

Origin of Impulses in Dorsal Spino-Cerebellar Tracts.—Following stimulation of peripheral nerves of the hind limb or direct stimulation of the direct tract in the cat, electrical responses have been recorded in the dorsal spino-cerebellar tract and in the lobulus centralis and adjacent folia of the culmen of the cerebellum. Impulses are conducted in the tract nearly twice as fast as in the fasciculus gracilis. Activity arises in the tract after a delay of 0·5–0·9 m. sec. following the arrival of the primary impulses in the collaterals to Clarke's column. To a single afferent volley the response in the tract is often a series of spikes each lasting about 0·5 m. sec. The fibres are able to respond again within 2 m. sec. after the beginning of an earlier response. The response evoked on stimulation of one afferent pathway frequently is conditioned by activity resulting from stimulation from another afferent nerve. The result may be inhibition or a summation of tract excitatory effects. The cells of origin of the tract fibres receive collaterals from more than one primary sensory neuron. Internuncial chains of varying degrees of complexity may also be involved. The early components of the cerebellar response to all the afferent systems activated by the tibial or peroneal nerves have been identified as largely due to the impulses of Flechsig's tract. Another component is produced independently. (W. M. H.)

Interference Factors after Removal of Frontal Lobes.—After bilateral removal of the frontal association areas, monkeys succeeded in delayed response tests when darkness was maintained during the delay interval. Unlike normal animals, however, they failed when there was a bright light during the delay interval. In the experiment described, the indirect method was used, that is, light instead of food was used as the cue stimulus. It is suggested that removal of the frontal association areas in primates leads to a marked impairment in their general capacities for memory, by making them more susceptible to retroactive inhibition. (W. M. H.)

Transmission in Nerve-Muscle Fibre.—In normal and curarized frog's muscle the transmitter action, i.e. the action of the depolarizing agent producing the end-plate-potential has been further examined. Polarizability of the muscle membrane is abolished during the greater part of the rising and falling phase of the propagation of a muscle impulse. No additional potential is produced by an e.p.p. or constant current pulse. A propagating muscle impulse is speeded up by the e.p.p. as it approaches the end-plate region. The similarities of e.p.p. and cat-electro-tonic potential are discussed. (W. M. H.)

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*Changes in Normal Electroencephalogram of *Macaca Mulatta* with Growth. M. A. Kennard and L. F. Nims. 325.
*Effect of Electroencephalogram of Lesions of Cerebral Cortex and Basal Ganglia in *Macaca Mulatta*. M. A. Kennard and L. F. Nims. 335.
Modification of Cortical Activity by Means of Intermittent Photic Stimulation of Monkey. W. C. Halstead, G. W. Knox, and A. E. Walker. 349.
*Relation of Fibrillation to Acetylcholine and Potassium Sensitivity in Denervated Skeletal Muscle. J. W. Magladery and D. Y. Solandt. 357.
Cerebellar Action Potentials in Response to Stimulation of Proprioceptors and Exteroceptors in the Rat. R. S. Dow and R. Anderson. 363.
*A Comparison of Effects of Upper and Lower Motor Neurone Lesions on Skeletal Muscle. D. Y. Solandt and J. W. Magladery. 373.
Stimulus Frequency as a Means of Analysing Synaptic Activity. C. G. Bernhard and R. Granit. 381.
*The Central Excitatory State associated with Postural Abnormalities. J. S. Denslow and C. C. Hassett. 393.
The Function of Components of the Respiratory Complex. R. F. Pitts. 403.

E.E.G. of Monkey with Growth.—In the monkey the e.e.g. becomes stabilized during the second year of life. As in man, the changes from birth are an increase in frequency, an early increase in amplitude followed by a slight decrease. In the monkey these potential changes may be related to the development of the C.N.S. which grows little after the second year. (W. M. H.)

E.E.G. and Lesions of Cerebral Cortex.—The effect on e.e.g. of lesions in the cortex and basal ganglia has been studied in 41 monkeys. The former cause no significant change save transient flattening and slowing. Lesions of the head of caudate nucleus or putamen cause "saw toothing" or "hypersynchrony" of the 8–10 p. sec. waves, with a falling out of the 15–20 p. sec. waves. Combined lesions of the motor arcas of the cortex and basal ganglia caused the most marked changes. True epilepsy appeared in 5 out of 15 such animals. (W.M.H.)

Effects of Motor Neurone Lesions on Skeletal Muscle.—Using albino rats the atrophy of the gastrocnemius-soleus group of muscles following an upper motor neurone lesion (produced by spinal cord section at the sixth thoracic segment) was compared with the atrophy following a lower motor neurone lesion (section of the sciatic nerve). The two types of lesions produced atrophic processes which were quantitatively similar for the first 14 days. Thereafter the muscle groups with severed upper motor neurones started to recover lost weight while those with lower motor neurones cut showed an uninterrupted development of atrophy. Both types of injury produced hypersensitivity to acetylcholine in the muscles involved. This lasted only as long as the atrophic process was active, and was most marked in the cases of section of the lower motor neurone. Fibrillation was seen only when the lower motor neurone was cut. Throughout, the mass reflex response in the plegic muscle showed no change, and there was never fibrillation. The plegic muscle was apparently at rest and showed no prolonged spastic state. Disuse, relative or absolute, appeared to be a constant factor. The cause of regression is therefore not easily surmized. (W. M. H.)

Fibrillation and Acetylcholine.—Denervation makes skeletal muscles much more sensitive to ACh and less markedly to potassium chloride. When these are injected intra-arterially they produce action potentials like those of fibrillation. Quinidine in doses that abolish fibrillation will abolish these potentials. It is suggested that fibrillation in denervated muscle is evidence of an increased sensitivity to chemical agents; usually acetylcholine, potassium, or both. (W. M. H.)

Excitatory State with Postural Abnormalities.—In many rigid muscles (lesion areas) associated with postural abnormalities commonly show spontaneous action potentials, or potentials easily evoked by suitable stimuli. The presence of an enduring C.E.S., possibly due to subthreshold stimuli, is postulated. (W. M. H.)

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Absence of Local Sign in Visceral Responses to Pain. D. G. Sattler. 417.
*Potentials Recorded from the Nerve Trunk and the Dorsal Root by Micro-Electrodes. H. O. Parrack. 423.
*Mediation of Descending Long Spinal Reflex Activity. D. P. C. Lloyd. 435.
Intersegmental Inhibition in the Spinal Cord of the Frog. H. Winterstein and M. Terzioglu. 459.
*Oscillographic Studies on the Spinal Tract of the Fifth Cranial Nerve. F. Harrison and K. B. Corbon. 465.
*Effects of Intensity and Wave Length on Driving Cortical Activity in Monkeys. W. C. Halstead, G. W. Knox, J. I. Woolf, and A. E. Walker. 483.
*Reflex Discharges in Branches of the Crural Nerve. B. Renshaw. 487.
*Action Potential and Enzyme Activity in the Electric Organ of *Electrophorus electricus* (Linnæus). I. Choline Esterase and Respiration. D. Nachmansohn, R. T. Cox, C. W. Coates, and A. L. Machado. 499.

Potentials Recorded by Micro-Electrodes.—The use of micro-electrodes in nerve trunks where large numbers of fibres are activated synchronously is discussed. To record in such circumstances single fibres the diameter must not exceed 15μ. Ganglionic potential curves so recorded show positive and negative phases which are assigned to initial activity in axones and later spread in the cell body. Single cell body potentials recorded from ganglia suggest a slowing of the depolarization wave as it invades the cell body. (W. M. H.)

Mediation of Spinal Reflex Activity.—Owing to the free decussations at the two levels transmission from the brachial to the lumbar region propriospinals may involve double decussation. The lateral columns appear more strictly concerned with strictly unilateral transmission. The ventral serve both unilateral and bilateral transmission. The functioning of the dorsal column is not clear from the present experiments. A brachial plexus volley first produces inhibition of ipsilateral lumbar motoneurons by unilateral pathways. Only one synapse appears involved. Following, there is activity of the interneurones and facilitation of the motoneurons for about 35 m. sec. In the lumbar region the active neuron pool is in the ventral half of the cord, the dorsal horn and most of the intermediate region remaining inactive. A degree of mutual interference takes place between long spinal reflex activity and short spinal reflex activity pertaining to multineuronal paths. This interference is designated as "mutual inhibition," for the deficit is frequently too great to be accounted for as occlusion. On the contrary, long spinal reflexes reinforce one another. (W. M. H.)

Oscillographic Studies on Fifth Cranial Nerve.—Responses of the spinal tract of the fifth nerve of the cat to tactile impulses and electrical stimulation of the divisions of the fifth nerve were studied oscillographically. The presence of touch conducting fibres in the spinal root is confirmed and previous anatomical findings supported regarding the relative position of the three divisions (ophthalmic ventrally, mandibular dorsally, and the inaxillary between). The rationale of Sjöquist's operation of tractotomy is discussed. (W. M. H.)

Wave-Length Effects on Cortical Activity.—The optimal conditions of driving of the electroencephalogram in the monkey were determined. With flash frequency ranging from 3 to 12·5 per sec. they were intensity of 80 foot candles, monochromatic light rather than neutral light of the same luminous energy, and light of the blue end of the spectrum rather than of the red region. (W. M. H.)

Reflex Discharges in Crural Nerve.—The authors have examined differences in activity in nerves to muscles of different function which arise from the same and adjacent segments of the spinal cord. In cats under pentobarbital

sodium anæsthesia, reflex discharges were evoked in the motor nerves of the satorius and vastus internus by the stimulation of dorsal groups. There was a constancy in these discharges from preparation to preparation. Stimulation of L6 dorsal root evoked in the nerves to vastus internus, a nearly synchronous discharge, and in the nerve to the sartorius a dispersed discharge of relatively long latency. An L7 dorsal root volley inhibited the discharge of vastus internus motoneurons produced by an L6 volley. The inhibitory effect continued for several hundred m. secs. In contrast an L7 volley produced in the nerve to the sartorius a discharge similar to that produced by an L6 volley. (W. M. H.)

Enzyme Activity in Electrophorus Electricus.—In Electrophorus electricus the concentration of choline esterase diminishes towards the tail and is shown to be closely correlated with the voltage per centimeter developed. With different substrates the respiration has been measured, but shown to be fairly uniform from the head to the caudal end. (W. M. H.)

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The Effects of Drugs, Sugar and Allied Substances on the Isolated Small Intestine of the Rabbit. W. Feldberg and O. M. Solandt. 137.
*The Diuretic Action of Alcohol in Man. M. G. Eggleton. 172.
Effects of Trimethylamine on Growth and Sexual Development in the Rat. H. Wastl. 192.
*The Cholinergic Nature of the Nerves to the Electric Organ of the *Torpedo* (*Torpedo Marmorata*). W. Feldberg and A. Fessard. 200.
The Determination of Plasma Volume by the Evans Blue Method. A. C. Crooke and C. J. O. Morris. 217.
*The Interrelation of Prostigmine, Adrenaline and Ephedrine in Skeletal Muscle. E. Bülbring and J. H. Burn. 224.
The Action of the Oxytoxic Hormone of the Pituitary Gland on Urine Secretion. A. M. Fraser. 236.
The Effect of Histidine on Histamine Shock. O. G. Edholm. 252.

Diuretic Action of Alcohol.—Diuresis following an alcoholic drink is roughly proportional to the total content of alcohol. It occurs 20–30 minutes after the drink. It may be inhibited by post-pituitary extract. The degree of diuresis varies widely in different subjects, probably according to variation in the natural rate of absorption and also to variations in sensitivity of the pituitary mechanism. The diuretic response is dependent mainly on the duration of increasing blood alcohol concentration. When equilibrium is established alcohol concentration in the urine remains 30–35 per cent. higher than that in the blood, but equal to that in the water of plasma. (W. M. H.)

Cholinergic Nature of Nerves to Electric Organ.—The electric organ yields on extraction of fresh tissue more than 0·1 per cent. of its dry weight of acetylcholine. Acetycholine would appear to be liberated on stimulation of the nerves to the organ perfused with eserinized saline solution. Eserine lengthens the phase of the single nervous discharge and causes rapid fatigue of the response to repetitive nerve stimulation. Injected ACh has an electrogenic effect. (W. M. H.)

Inter-relation of Prostigmine, Adrenaline, and Ephedrine.—Adrenaline augments the increase in tension in a nerve muscle preparation produced by the injection of prostigmine. To a lesser extent it augments the effect of eserine. At high rates of stimulation this potentiating effect of adrenaline changes to a depression, possibly because of an excessive accumulation of acetylcholine. Ephedrine has no action like that of adrenaline in relation to prostimine, but it will augment the effect of adrenaline. These findings on the potentiation of accumulated acetylcholine suggest an explanation of the Orbeli phenomenon and of clinical use of ephedrine in addition to prostigmine in myasthenia gravis. (W. M. H.)

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Factors affecting Bicarbonate Content, Free CO_2 and *p*H of Urine. J. A. Barclay. 257.
The Hæmolytic Action of Potassium Salts. H. Davson. 265.
Preparation and Some Properties of Hypertension (Angiotonin). P. Edman, U. S. von Euler, E. Jorpes, and O. T. Sjöstrand. 384.
*An Action of Adrenaline on Transmission in Sympathetic Ganglia, which may Play a Part in Shock. E. Bülbring and J. H. Burn. 289.
Mineral Metabolism on Dephytinised Bread. R. A. McCance and E. M. Widdowson. 304.
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The Effect of Graded Doses of Vitamin C upon the Regeneration of Bone in Guinea-Pigs on a Scorbutic Diet. 327.
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The Significance of Urinary Calcium, Magnesium and Phosphorus. R. A. McCance and E. M. Widdowson. 350.
*The Effect of Anæsthesia on the Adrenaline Content of the Suprarenal Glands. P. C. Elmes and A. A. Jefferson. 355.
*The Effect of Variations in the Subarachnoid Pressure on the Venous Pressure in the Superior Longitudinal Sinus and in the Torcular of the Dog. T. H. B. Bedford. 362.
Acceleration of the Heart by the Vagus in Cats after Complete Sympathectomy. G. L. Brown and W. d'A. Maycock. 369.
Pulmonary Circulation Times before and after Functional Closure of the Ductus Arteriosus. A. E. Barclay, J. Barcroft, D. H. Barron, K. J. Franklin, and M. M. L. Pritchard. 375.

Adrenaline and Transmission in Sympathetic Ganglia.—Adrenaline is shown to augment sympathetic effects when its circulation is confined to the ganglia, but in large doses it is depressant. In small doses it increases, in large it decreases the stimulating action of acetylcholine in atropinized spinal cats; likewise it increases and depresses the pressor effect of splanchnic stimulation in spinal cats in which the suprarenal glands are excluded. These observations support the view that excessive liberation of adrenaline may be important in shock. (W. M. H.)

Anæsthesia and Adrenaline Content of Suprarenal Glands.—In cats the differences in the adrenaline content of the normal and denervated suprarenal after periods of anæsthesia were measured by bioassay. Under ether 6·7+1·4 per cent. (6) of the original content was lost per hour, under cyclopropane 4·45+1·8 per cent. (5), and under pentobarbitone–morphine 2·7+6·0 per cent. (5). Part of the fall of B.P. under ether is assigned to the vasodilator action of adrenaline. Under cyclopropane vasometer control is increased, heart muscle is more excitable, vagus tone is increased, and blood pressure remains normal. (W. M. H.)

Variations in Subarachnoid and Venous Pressure.—In dogs increase in subarachnoid pressure, effected by the injection of normal saline solution, even when slowly, produces a small but persistent fall in the venous pressure in the superior longitudinal sinus and in the torcular. (W. M. H.)

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BOOK REVIEWS

AIDS TO THE INVESTIGATION OF PERIPHERAL NERVE INJURIES

M.R.C. War Memorandum No. 7

(H.M. Stationery Office. 1942. Pp. 48. 2*s*.)

The main purpose of this small booklet is to illustrate the practical methods of testing the action of all the individual muscles of both extremities, and this is accomplished by photographs which are excellently reproduced and which clearly demonstrate how the observer should hold the limb and how to instruct the patient to bring into action the desired muscle.

An alternative method of testing is occasionally given, but in the case of the small muscles of the hand some useful manœuvres are omitted and insufficient stress is laid on the detection of trick movements. Another criticism is that the illustrations are all taken from normal individuals and tend to give the reader a false sense of the ease with which paralysis or weakness of contractions can be detected.

Two valuable features are that the legends state the nerve supply and the main segmental innervation of each muscle and that there are a series of line drawings illustrating maximal, average, and minimal areas of sensory loss in lesions of the important peripheral nerves.

As an introductory treatise to a newcomer to peripheral nerve investigation and as a means of quick reference to those more experienced the booklet will prove useful.

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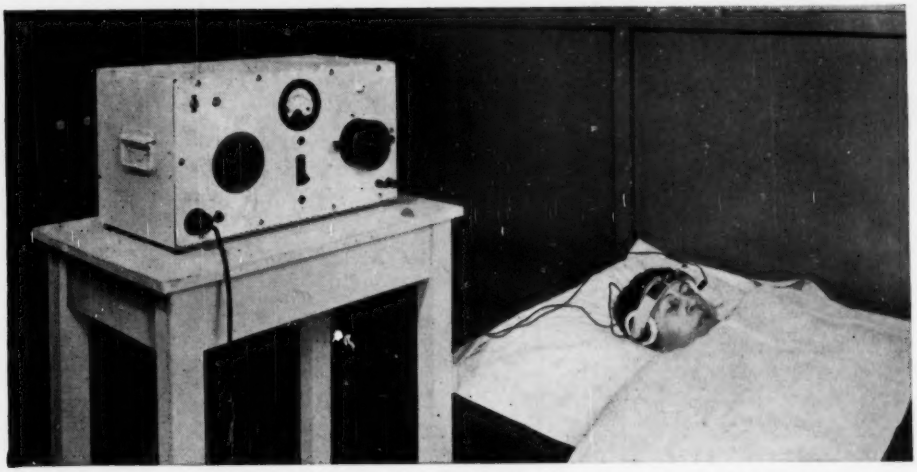

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